FINAL REPORT
ADDITIONAL SUBSURFACE SOIL AND GROUNDWATER ASSESSMENT
PILOT CHEMICAL COMPANY FACILITY
Santa Fe Springs, California

Project 50-2219-02

July 1991

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AND GROUNDWATER ASSESSMENT
PILOT CHEMICAL COMPANY FACILITY
Santa Fe Springs, California

Project 50-2219-02

FOR SUBMITTAL TO:

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INTRODUCTION

Kleinfelder, Inc. (Kleinfelder), was retained by Pilot Chemical Company to conduct an additional preliminary subsurface site assessment at their Santa Fe Springs, California, facility (refer to Figure 1 - Site Location Map). This additional work was requested by the State of California, California Regional Water Quality Control Board (CRWQCB). A work plan for this work was approved by the CRWQCB on August 17, 1990. The CRWQCB has since deferred to the Los Angeles County Department of Public Works (LACDPW), which became the lead agency on this project. The site is primarily used to manufacture detergent for industrial and general purposes. The site had previously been assessed in July 1988 by Clayton Environmental Consultants, Inc., of Cypress, California. As part of this previous study, several underground storage tanks containing toluene, total xylenes, and caustic material used in the production of detergent were removed, and four wells were installed in the vicinity of these tanks. The underground storage tanks were located along the western boundary of the property. The four wells that were installed as part of this previous study are numbered MW-1, MW-2, MW-3, and EW-4 (refer to Figure 2 - Site Map With Monitoring Well Locations). In addition to well installation, some soil that had been contaminated with detergent raw material (alkylbenzene) had been excavated from the railroad property near the northwestern corner of the property.

Kleinfelder has been retained by Pilot Chemical Company to conduct an additional subsurface assessment. The field operations of this additional assessment was completed in April 1991, which comprised drilling of seven soil borings that were completed as wells by installing 4-inch factory machine-slotted PVC screen and casing. Soil samples that were collected from these soil borings were analyzed for the presence of volatile petroleum hydrocarbon and volatile aromatic hydrocarbon compounds. In addition to soil samples collected, groundwater from the installed wells was sampled following development and purging. Groundwater samples collected were to be analyzed for the presence of caustics (pH), surfactants (MBAS), and aromatic petroleum hydrocarbon compounds.

The background information of the geology and hydrogeology of the site and surrounding areas, the methods of soil sampling, well installation, and groundwater purging and sampling, as well as the reported concentrations from the state-certified analytical laboratory of the chemical analyses conducted on both soil and groundwater are reported in this document.

GEOLOGY AND HYDROGEOLOGY

The Pilot Chemical Company facility in Santa Fe Springs, California, is located in the southwest 1/4 of the southeast 1/4 of the southeast 1/4 of section 30 of township 2 south, range 11 west San Bernardino baseline and meridian. The average surface elevation for the site is approximately 152 feet above mean sea level. The site lies within the Santa Fe Springs Plain area of the coastal plain of Los Angeles County, California. The Santa Fe Springs Plain is a low, slightly rolling topographic feature that has been warped by the Santa Fe Springs-Coyote Hills anticlinal system. This plain dips gently both to the northeast (toward Whittier) and to the southwest (toward the Downey Plain), with an elevation difference of 175 to 200 feet above sea level (Department of Water Resources, 1961).

The major structural feature in the area is the Whittier fault zone, which is approximately 2.5 miles northeast of the site along the southern flank of the Puente Hills. This west-northwest trending fault zone has a right oblique net slip estimated at 15,000 feet. Portions of the fault zone are known to have been active in Holocene time (the last 11,000 years), and thus are included in a Special Studies Zone under the Alquist-Priolo Special Studies Zones Act of 1972 (Hart, 1988).

The site is located on upper Pleistocene-aged alluvium of the Lakewood Formation. The Lakewood Formation unconformably overlies the lower Pleistocene San Pedro Formation, the Pliocene Pico and Repetto Formations, and the Miocene Puente Formation.

Soil borings and monitoring well installations have allowed soil logging and sampling on the site to a maximum depth of 76 feet. The alluvial materials encountered consisted primarily of alternating intervals of olive, fine- to medium-grained sand and yellowish brown silty sand and clayey silt.

Los Angeles Flood Control District well 1615P is located approximately 3 miles southwest of the site. The water level was measured at 65.9 feet below ground surface (a groundwater elevation of 70.1 feet above mean sea level), on October 2, 1990. Groundwater levels in this well have ranged from a high of 22.4 feet below ground surface in 1947, to a low of 126.3 feet below ground surface in 1958.

A rainfall station located approximately 1.5 miles north of the site at Whittier City Hall (Los Angeles Flood Control District number 106C) received an average annual rainfall of 14.6 inches between 1927 and 1980. Extreme annual rainfall values include a low of 5.03 inches in the 1960-1961 year, and a high of 33.21 inches in the 1977-1978 period. Most of the rainfall occurs between December and March.

The San Gabriel River, the only surface water within 1 mile of the site, is approximately 0.8-mile west of the site. In this area, the river is contained within a channel having improved concrete walls with an open bottom. A gauging station approximately 2 miles south on the San Gabriel River above Florence Avenue (Los Angeles Flood Control District number F262B-R) indicate an average mean daily flow of 42.4 cubic feet per second (cfs) for the period of 1934 to 1980. Annual values for mean daily flows range from a low of 0.9 cfs in 1960-1961, to a high of 273 cfs in 1968-1969.

GROUNDWATER MONITORING WELL INSTALLATION AND SAMPLING

From April 2 to 18, 1991, Kleinfelder's subcontractor Spectrum Drilling of Signal Hill, California, and a Kleinfelder staff geologist used a truck-mounted CME-75 drill rig to bore seven 10-inch diameter soil borings. The soil borings were then converted into seven 4-inch diameter PVC groundwater monitoring wells (wells MW-5 through MW-11). Five wells (MW-5 through MW-9) were installed along the western boundary of the site near the location of the former underground and existing aboveground storage tanks. Well MW-5 was installed adjacent to the area that had been excavated in the northwestern portion of the property. One well (MW-10) was installed within the plant's existing aboveground tank farm, and one well (MW-11) was installed upgradient of present and former aboveground and underground storage tanks. However, MW-11 is in an area for loading for the final detergent product into tanker trucks.

SOIL BORING AND EQUIPMENT DECONTAMINATION PROCEDURES

The hollow-stem auger and downhole equipment were steam-cleaned between soil borings to minimize the potential for cross-contamination. The field geologist collected soil samples from each soil boring at the 5, 10, 15, 20, 25, 30, 35, 40, 45, and 50 feet depths below ground surface. Due to difficult drilling conditions, the remaining soils at depths were logged by visual inspection of the cuttings as they came from the augers. Soil samples that were collected for chemical analyses were taken in brass sample collection tubes using a split-spoon sampler and a 140-pound downhole hammer. Duplicate soil samples were collected from all depths and screened using a HNu® photoionization detector. Results of the field screening are included on the boring logs included as Appendix A - Soil Borings and Field Logs.

SOIL SAMPLING PROTOCOL

Soil samples were visually logged and classified using the Unified Soil Classification System. Soil sample collection brass tubes were sealed with Teflon® film, covered with plastic caps, labeled as to sample location, and placed in an ice-filled chest to preserve chemical integrity during transport to the chemical laboratory for analyses (refer to Appendix B - Soil Sampling Protocol).

During drilling, Pilot Chemical Company provided a sufficient number of Federal Department of Transportation (DOT)-approved hazardous waste drums for storage of drill cuttings and wastewater generated during soil boring, installation, surging, bailing, and purging of each well.

GROUNDWATER MONITORING WELL CONSTRUCTION DETAILS

All seven groundwater monitoring wells were completed to a depth of about 75 feet below ground surface by the following methods.

Groundwater monitoring wells were constructed using 4-inch diameter schedule 40, flush-threaded polyvinyl chloride (PVC) well casing, and PVC well screen with factory machined 0.020-inch slots. The bottom 20 feet of the well was screened, and the upper 55 feet was blank casing. Tools and well casing was steam-cleaned prior to drilling and construction of the wells.

A #3 Monterey® sand filter pack was installed in the annulus around the well screen to approximately 2 feet above the top of the well screen. A 2-foot-thick bentonite seal was constructed above the filter pack using 3/8-inch-diameter bentonite pellets. The bentonite seal was hydrated with 2 gallons of deionized water. The remaining annulus to a depth of 1 foot below ground surface was sealed with Volclay® grout (a bentonite grout), and the upper 1 foot of the annulus was filled with Portland® cement. A 12-inch, flush-mounted, lockable well cover was cemented into place on all wells, except MW-7 and MW-9, to protect the top of the well casing (refer to Figure 3 - Groundwater Monitoring Well Construction Details). Wells MW-7 and MW-9 were completed with 8-inch diameter aboveground monuments.

GROUNDWATER MONITORING WELL DEVELOPMENT AND SAMPLING

Kleinfelder provided groundwater monitoring well sampling equipment, and a field technician monitored by a registered geologist to develop and sample groundwater monitoring wells. All new and existing wells, except for EW-4, were sampled as part of this study. EW-4 was not included in the groundwater monitoring program at the time of the groundwater sampling event due to access problems. Groundwater levels were measured prior to purging and sampling and are listed in Table 1 - Groundwater Elevations. Temperature, conductivity, and pH of the groundwater were measured at time intervals during the purge, and recorded on field sampling logs which are included as Appendix C - Field Sampling Logs. Groundwater sampling involving the existing wells (MW-1, MW-2, and MW-3) was conducted with our standard sampling protocol for wells whose diameter is less than 4 inches (refer to Appendix D - Groundwater Sampling Protocol for Wells Smaller Than 4 Inches in Diameter).

Groundwater sampling for the newly installed wells was conducted in accordance with our standard sampling protocol (refer to Appendix E - Groundwater Sampling Protocol for Wells 4 Inches or Larger in Diameter). Duplicate groundwater samples were collected in laboratory prepared sample bottles after three well volumes of water had been evacuated from the well. Groundwater samples were stored in an ice-filled cooler for transport to Kleinfelder's state-certified analytical laboratory.

Pilot Chemical Company provided federal DOT-approved hazardous waste drums for storage of water discharged during well development and sampling. The drums were labeled with the groundwater monitoring well number, date and contents, and stored onsite until the groundwater could be characterized for proper disposal

GROUNDWATER MONITORING WELL ELEVATION SURVEY

All existing groundwater monitoring wells present onsite were surveyed for their respective surface elevations relative to mean sea level in June 1991. The elevations were measured by a survey from a benchmark located in the intersection of Burke Street and Skabo Street, approximately 300 feet west of the front entrance to the plant. The survey was completed by John Combs of Combs Land Surveying in Cerritos, California. The results of the survey are included as Appendix F - Land Survey Results. The survey indicated that the surface elevation does not vary more than 4 feet across the site. The average surface elevation for the site is 152.41 feet above mean sea level. Individual well elevations are included on Figure 2 and in Table 1.

GROUNDWATER MEASUREMENTS

During well installation, the depth at which first groundwater was encountered was recorded and noted on the field boring log (refer to Appendix A). Groundwater was first encountered between 53 and 57 feet below ground surface in the seven wells installed by Kleinfelder. Once the wells had been installed, groundwater levels in all wells (new and existing), except EW-4, were measured and recorded on field sampling logs (refer to Appendix C). The results of the depth to groundwater measurements are included in Table 1. The depth to groundwater in all the wells that were measured ranged from about 47 to 51 feet below ground surface. The groundwater contours and groundwater gradient are included on Figure 4 - Groundwater Gradient Map. Groundwater elevations decrease from 104.45 feet in well MW-5 located along the northwest corner of the property, to 102.55 feet in well MW-9 located in the southwest portion of the property. Groundwater flow direction is to the southwest with a groundwater gradient of 5.22×10^{-3} ft/ft. The rise in water level between the encountered and static water levels suggests that the groundwater is apparently under hydrostatic pressure.

LABORATORY ANALYSES

The soil samples collected from the wells installed by Kleinfelder and the groundwater samples collected from the wells onsite, except for EW-4, were transported to Kleinfelder's contract state-certified laboratory, Analytical Technologies, Inc. (ATI), located in San Diego, California, under chain-of-custody procedures for chemical analyses. The soil samples collected at the 10, 20, 30, 40, and 50 feet intervals below ground surface were analyzed for total volatile petroleum hydrocarbon compounds using United States Environmental Protection Agency (U.S. EPA) method 8015, and for volatile aromatic hydrocarbon compounds using U.S. EPA method 8020. The groundwater samples collected were analyzed for pH using U.S. EPA method 9040, surfactant (MBAS, detergents) using U.S. EPA method 425.1, and volatile aromatic hydrocarbon compounds using U.S. EPA method 8020 (refer to Appendix G - Laboratory Reports and Chain-of-Custody Records).

SOIL SAMPLES ANALYTICAL RESULTS

The reported analytical results for the soil samples from Appendix G are tabulated in Table 2 - Reported Chemical Results of Soil Samples.

Total Volatile Petroleum Hydrocarbon Compounds (TVPH) (U.S. EPA Method 8015)

Soil samples collected from three of the seven soil borings installed (MW-7, MW-8, and MW-10) had detectable concentrations of TVPH above the laboratory detection limit of 5 milligrams per kilogram (mg/kg). The shallow (10-foot) and intermediate (30-foot) depth zones had some detectable concentrations of TVPH in the area of boring MW-7, MW-8, and MW-10 (refer to Figure 5 - Total Volatile Petroleum Hydrocarbon Compound Concentrations in Soil at 30 Feet Below Ground Surface). The highest reported concentrations of TVPH was from the deep (50-foot) depth zone. The 50-foot soil sample from boring MW-8 had a reported TVPH concentration of 4,700 mg/kg (refer to Figure 6 - Total Volatile Petroleum Hydrocarbon Compound Concentrations in Soil at 50 Feet Below Ground Surface). The other detectable concentrations of TVPH in soil samples collected were below 60 mg/kg.

Volatile Aromatic Hydrocarbon Compounds (BTEX) (U.S. EPA Method 8020)

Toluene was detected in at least one soil sample collected from all seven soil borings. The 20-foot soil sample from borings MW-5 and MW-11 had toluene concentrations of 0.008 and 0.0072 mg/kg, respectively. No other BTEX compounds were detected in soil samples collected from soil borings MW-5 and MW-11 above the individual organic compound's detection limit concentration (refer to Table 2). Soil from MW-9 had reported toluene concentrations of 0.010 mg/kg for all soil but the 10-foot samples analyzed. The 10-foot soil sample had a reported toluene concentration of 0.009 mg/kg. Reported toluene concentrations from the 20-foot soil sample from MW-5, the 10- and 20-foot soil samples from MW-8, and all soil samples analyzed from MW-6, MW-9, and MW-11 with reported toluene, ethylbenzene, and total xylenes (TEX) concentrations are at concentrations less than three times the detection limit. This reported concentration is questionable and may be due to laboratory error or another external source of contamination.

TEX were detected at varying concentrations in soil samples collected from the remaining five soil borings (refer to Figure 7 - Toluene Concentrations in Soils at 30 Feet Below Ground Surface, and Figure 8 - Toluene Concentrations in Soils at 50 Feet Below Ground Surface). Soil boring MW-8 had the highest concentration of TEX. The 40-foot and 50-foot samples from boring MW-8 had a TVPH concentrations of 29 mg/kg and 4,700 mg/kg, respectively. The TEX concentrations of the 40-foot sample from boring MW-8 were 63 mg/kg, 33 mg/kg, and 86 mg/kg, respectively. The TEX concentrations of the 50-foot sample from boring MW-8 were 400 mg/kg, 30 mg/kg, and 1,000 mg/kg, respectively. The 50-foot soil sample from boring MW-10 had TEX concentrations of 13.9 mg/kg, 1.4 mg/kg, and 5.4 mg/kg, respectively. The 10-foot and 40-foot soil samples collected from boring MW-7 had TEX concentrations of 1.1 mg/kg, 1.8 mg/kg, and 10 mg/kg, and 6 mg/kg, 2.2 mg/kg, and 8.3 mg/kg, respectively. The remaining detected concentrations of TEX in the soil samples collected were below 1 mg/kg.

The areal extent of the TEX concentrations reported in the soil correspond to the areal extent of the reported TVPH concentrations (refer to Figures 5 and 7). Both the TVPH and TEX concentrations indicate that these compounds are still present in soil in the vicinity of the previous underground storage tanks.

There was an apparent discrepancy in values obtained for TVPH concentrations and total BTEX concentrations for the 40-foot soil sample of boring MW-7, the 40-foot sample of boring MW-8, and the 50-foot sample for boring MW-10 (refer to Table 2). The sum of the BTEX concentrations reported is greater than the TVPH concentration for the same soil sample. The 40-foot soil sample for boring MW-7 and the 50-foot soil sample from boring MW-10, are probably within the error of measurement and may not be related to an inherent trait of the sample or error in the analytical process. However, regarding the 40-foot soil sample of boring MW-8, Mr. Gary Stewart, fuel laboratory supervisor, of ATI (San Diego), assessed the apparent discrepancy as "varying concentrations within a non-homogeneous soil sample." The soil onsite is a layered sequence of stream-deposited silt and silty clay interbedded with sand. The act of mixing the soil sample would cause some volatiles to be lost, therefore, the samples are analyzed as whole samples. If one soil type (e.g., silts and clays) retained more volatiles than another, it would be possible to analyze one portion of the sample which contained volatile-retaining soil such as silt for BTEX, and analyze a soil type from the same sample that does not retain volatiles as readily such as sand and obtain lower TVPH concentrations than the sum concentrations of BTEX.

Benzene was not detected in any of the soil samples collected. However, three soil samples that were collected and analyzed (the 40- and 50-foot soil samples from boring MW-8 and the 50-foot soil sample from boring MW-10), had elevated concentrations of other compounds which required a dilution of the aliquoit derived from the soil samples prior to analyses. This dilution increased the detection limits from a concentration of 0.005 mg/kg to 0.63 mg/kg for the two soil samples collected from boring MW-8, and 1.3 mg/kg for the 50-foot soil sample collected from boring MW-10.

GROUNDWATER ANALYTICAL RESULTS

The reported analytical results for the groundwater samples from Appendix G are tabulated in Table 3 - Reported Chemical Results of Groundwater Samples.

pH (U.S. EPA Method 9040)

The pH of groundwater samples collected that were analyzed by the laboratory ranged from 7.17 from groundwater collected from MW-3, to 7.54 from groundwater collected from MW-9. The background value is 7.39 from well MW-11. There seems to be no statistical difference between the background concentrations and the rest of the pH values. There does not seem to be any significant variations in groundwater pH due to the presence of the underground caustic storage tanks.

Surfactants (MBAS) (U.S. EPA Method 425.1)

MBAS are present in groundwater collected from seven of the 10 wells sampled (refer to Figure 9 - MBAS Concentrations (milligrams per liter) in Groundwater). The four wells with concentrations of MBAS over the Federal Drinking Water Standard of 0.5 milligrams per liter (mg/l), are wells MW-11 (2.2 mg/l), MW-3 (2 mg/l), MW-10 (1.2 mg/l), and MW-1 (0.8 mg/l). Only wells MW-5, MW-6, and MW-7 had no detectable concentrations of MBAS above the laboratory detection limit concentration of 0.1 mg/l.

Volatile Aromatic Hydrocarbon Compounds (BTEX) (U.S. EPA Method 8020)

BTEX compounds are present in all groundwater samples collected (refer to Figure 10 - Toluene Concentrations (micrograms per liter) in Groundwater). Well MW-3 had the highest concentrations of BTEX compounds with toluene at 110,000 micrograms per liter (μg/l), ethylbenzene at 14,000 μg/l, and total xylenes at 52,000 μg/l. Nearby wells MW-1 and MW-2 also had elevated concentrations of TEX, with reported concentrations for groundwater from well MW-1 of 18,000 μg/l, 3,600 μg/l, and 12,000 μg/l, respectively, and reported TEX concentrations for groundwater from well MW-2 of 7,500 μg/l, 970 μg/l, and 4,000 μg/l, respectively.

Other wells with reported elevated concentrations of TEX are well MW-8 (550 μg/l, 180 μg/l, and 740 μg/l, respectively) and MW-10 (35 μg/l, 27 μg/l, and 170 μg/l, respectively). Total xylenes in well MW-9 had a concentration of 33 μg/l. All other reported groundwater TEX concentrations are under 10 μg/l.

Benzene was reported in groundwater samples collected from wells MW-5 (3.2 μg/l), MW-6 (0.61 μg/l), and MW-9 (4.8 μg/l). Benzene was not detected in any other groundwater sample collected. Since there is no point source near well MW-5, the benzene reported in the groundwater must have originated from an upgradient source. Detection limits for benzene in several groundwater samples are higher due to the necessary dilutions for groundwater samples with elevated concentrations of other analyzed compounds. The laboratory limit of detection dilution for benzene in well MW-3 is 13,000 μg/l for well MW-1 is 2,500 μg/l, for well MW-2 is 500 μg/l, for well MW-8 is 50 μg/l, for well MW-10 is 10 μg/l, and for well MW-7 is 2 μg/l.

INTERPRETATION OF DATA

SOIL

The reported laboratory results from soil samples indicates two possible assessments.

1. There is an area of contamination within the soil in the vicinity of soil borings MW-7, MW-8, and MW-10. The highest reported elevated concentrations of TVPH and TEX are at 40-foot to 50-foot below ground surface interval in the vicinity of boring MW-8. The area of TVPH and TEX contamination within the 10-foot sampling zone is within the same area, which is the nearest boring to the former position of the underground total xylenes and toluene storage tanks. The hydrocarbon compounds that apparently leaked from the underground storage tanks in the vicinity of well MW-7 have not migrated laterally within the shallow or intermediate depth zones (refer to Figure 5 and Figure 7). The presence of the highest reported contamination concentrations within the soil from the 40- to 50-foot range indicates that TVPH and TEX (refer to Figure 6 and Figure 8) have reached the groundwater and are present in the capillary fringe. The contaminating material appears to have migrated within the soil westward offsite to an unknown extent (refer to Figure 6 and Figure 8).

2. The presence of low concentrations of at least one TEX compound in nearly all soil borings indicates that the reported concentrations may be questionable due to sampling or analytical error. However, another possible explanation for the reported low concentrations for toluene is that the volatile TEX compounds may have migrated through the soil in the vapor phase. The 20-foot soil sample from all seven soil borings had toluene detected in concentrations ranging 0.0072 mg/kg (MW-11) to 0.043 mg/kg (MW-10). The 20-foot interval in all soil borings was a fine- to coarse-grained sand. This type of sand has a high porosity with abundant voids and airspaces. Rainwater and others (1988) demonstrated that volatile compounds such as toluene would not remain entirely in a liquid phase within such a medium, rather a small volume of the toluene would volatilize and migrate readily through the pore-space available in the vapor phase at a higher spreading rate. This vapor-phase migration may produce a large areal extent of low concentrations of toluene within the porous sand interval present at 20 feet below ground surface.

GROUNDWATER

The reported laboratory results from the groundwater samples indicate that the groundwater has been contaminated with MBAS and BTEX. The reported pH of the groundwater in the vicinity of MW-7 and MW-10 is statistically consistent with background pH values from the upgradient well MW-11. MBAS is present in four wells (MW-11, MW-3, MW-10, and MW-1) at concentrations above Federal Drinking Water Standards.

BTEX compounds are at the greatest concentrations in the area of well MW-3. The areal extent and the location of maximum concentration indicates that the contaminants observed (MBAS and BTEX) have migrated southwest and east of their respective point sources. The variation of migration direction may reflect historic variations in groundwater gradients. The southwest migration direction is consistent with the gradient flow of the groundwater beneath the site during this sampling event. The migration velocity may be aided by the presence of the highest concentration of TVPH and TEX within the soil samples collected, indicating that a significant amount of TVPH and TEX has contaminated the capillary fringe. The offset of the area of maximum reported groundwater contamination from the area of reported elevated concentrations of contaminants in the soil may be due to the phenomena of multiphase flow and the ability of the contaminant material that is migrating to "wet" the pore space in the capillary zone (Schwille, 1984). Stephanotos (1988) uses this principle to demonstrate that contaminants migrating in the groundwater may migrate faster within the capillary fringe.

CONCLUSIONS

The following conclusions are based on the data collected during this assessment and are subject to the limitations stated in this report. These conclusions may change if additional information becomes available.

Seven soil borings were drilled and completed with 4-inch diameter PVC wells to an approximate depth of 75 feet. Groundwater was encountered at 55 feet, however, groundwater beneath the site is under hydrostatic pressure. Groundwater had risen to about 47 feet within the wells that were installed. Groundwater flow direction is to the southwest with a gradient of 5.22×10^{-3} ft/ft.

Analyses of the soil indicated that there was some soil contamination in the vicinity of the former underground storage tank locations at the shallow (10-foot), intermediate (30-foot), and deep (50-foot) soil depths below ground surface. Contamination in the deep zone has contaminated the capillary fringe associated with groundwater and has migrated westward offsite to an unknown extent.

The groundwater was sampled from all wells except EW-4, and analyzed for volatile aromatic compounds (BTEX), pH, and surfractants (MBAS). Groundwater results indicate that MBAS and BTEX compounds are present in the groundwater. These contaminants appear to be migrating with the groundwater gradient to the southwest and east. The migration of contaminants may be aided by the phenomena of increased migration rates due to multiphase flow of contaminants within the capillary fringe.

LIMITATIONS

REPORT USE

This document is prepared for the sole use and benefit of Pilot Chemical Company and is based in part upon documents, writings and information owned and possessed by Pilot Chemical Company. Neither this report, nor any of the information contained herein, shall be used or relied upon by any person or entity other than Pilot Chemical Company.

The responsibility for making any disclosures or reports to any third party and for taking a corrective, remedial, or mitigative action shall be solely that of Pilot Chemical Company.

The conclusions and recommendations in this report are based on the following:

1. Observations by Kleinfelder personnel
2. Laboratory analysis performed by Analytical Technologies, Inc., San Diego
3. Information supplied by Pilot Chemical Company.

Portions of any oral or written report are based upon the information acquired during the investigation. It is possible the unpermitted, undocumented, or concealed improvements to the property could exist beyond the limits explored during the course of the investigation.

It is possible that variations in the soil or groundwater conditions could exist beyond the points explored in this investigation. Also, changes in the groundwater conditions found could occur at some time in the future due to variations in rainfall, temperature, regional water usage, or other factors.

The services performed by Kleinfelder have been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions in southern California. No warranty is expressed or implied.

This report may be used only by Pilot Chemical Company and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both onsite and offsite) or other factors may change over time, and additional work may be required with the passage of time. Any party, other than Pilot Chemical Company who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by Pilot Chemical Company or anyone else will release Kleinfelder from liability resulting from the use of this report by any unauthorized party.

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TABLE 1
GROUNDWATER ELEVATIONS
PILOT CHEMICAL COMPANY
Santa Fe Springs, California
Project 50-2219-02
July 1991

Well Number	Date Measured	Surface Elevation (Top of Well Casing) (feet)	Measured Depth to Groundwater (feet)	Groundwater Elevation (feet)
MW-1	4/30/91	152.44	48.85	103.59
MW-2	4/30/91	153.455	50.2	103.255
MW-3	4/30/91	153.705	50.7	103.005
EW-4	NM	155.18	NM	NM
MW-5	4/23/91	151.705	47.25	104.455
MW-6	4/23/91	151.775	47.55	104.225
MW-7	4/29/91	153.28	49.50	103.78
MW-8	4/23/91	151.55	48.05	103.50
MW-9	4/29/91	151.60	49.05	102.55
MW-10	4/29/91	153.16	49.3	103.86
MW-11	4/29/91	152.48	48.3	104.18

Notes:
NM = not measured

TABLE 2
REPORTED CHEMICAL RESULTS OF SOIL SAMPLES
TOTAL VOLATILE PETROLEUM HYDROCARBON COMPOUNDS (U.S. EPA METHOD 8015)
AND VOLATILE AROMATIC HYDROCARBON COMPOUNDS (U.S. EPA METHOD 8020)
PILOT CHEMICAL COMPANY
Santa Fe Springs, California
Project 50-2219-02
July 1991

(Concentrations in milligrams per kilogram - mg/kg)

Well Number	Depth of Analyzed Soil Sample (feet bgs[a])	U.S. EPA Method 8015 Total Volatile Petroleum Hydrocarbon Compounds[b]	U.S. EPA Method 8020 Volatile Aromatic Hydrocarbon Compounds			
			Benzene (B)	Toluene (T)	Ethyl-Benzene (E)	Total Xylenes (X)
MW-5	10	ND (5)[c]	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.010)
	20	ND (5)	ND (0.005)	0.008	ND (0.005)	ND (0.010)
	30	ND (5)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.010)
	40	ND (5)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.010)
	50	ND (5)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.010)
MW-6	10	ND (5)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.010)
	20	ND (5)	ND (0.005)	0.010	ND (0.005)	ND (0.005)
	30	ND (5)	ND (0.005)	0.013	ND (0.005)	ND (0.005)
	40	ND (5)	ND (0.005)	0.009	ND (0.005)	0.015
	50	ND (5)	ND (0.005)	0.010	ND (0.005)	ND (0.005)
MW-7	10	59 (D)[b]	ND (0.005)	1.1	1.8	10
	20	ND (5)	ND (0.005)	0.043	ND (0.005)	0.043
	30	9.8 (D)[b]	ND (0.005)	0.102	0.050	0.213
	40	15 (G)[b&d]	ND (0.005)	6	2.2	8.3
	50	ND (5)	ND (0.005)	0.014	0.008	0.030
MW-8	10	ND (5)	ND (0.005)	0.010	ND (0.005)	ND (0.010)
	20	ND (5)	ND (0.005)	0.011	ND (0.005)	0.011
	30	ND (5)	ND (0.005)	0.026	0.013	0.060
	40	29 (G)[b&d]	ND (0.63)	63	33	86
	50	4,700 (G)[b&d]	ND (6.3)	400	300	1,000
MW-9	10	ND (5)	ND (0.005)	0.009	ND (0.005)	ND (0.010)
	20	ND (5)	ND (0.005)	0.010	ND (0.005)	ND (0.010)
	30	ND (5)	ND (0.005)	0.010	ND (0.005)	ND (0.010)
	40	ND (5)	ND (0.005)	0.010	ND (0.005)	ND (0.010)
	50	ND (5)	ND (0.005)	0.010	ND (0.005)	0.020

TABLE 2
REPORTED CHEMICAL RESULTS OF SOIL SAMPLES
TOTAL VOLATILE PETROLEUM HYDROCARBON COMPOUNDS (U.S. EPA METHOD 8015)
AND VOLATILE AROMATIC HYDROCARBON COMPOUNDS (U.S. EPA METHOD 8020)
PILOT CHEMICAL COMPANY
Santa Fe Springs, California
Project 50-2219-02
July 1991

(Concentrations in milligrams per kilogram - mg/kg)

Well Number	Depth of Analyzed Soil Sample (feet bgs[a])	U.S. EPA Method 8015 Total Volatile Petroleum Hydrocarbon Compounds[b]	U.S. EPA Method 8020 Volatile Aromatic Hydrocarbon Compounds			
			Benzene (B)	Toluene (T)	Ethyl-Benzene (E)	Total Xylenes (X)
MW-10	10	ND (5)	ND (0.005)	0.688	0.057	0.24
	20	ND (5)	ND (0.005)	0.043	0.007	0.03
	30	ND (5)	ND (0.005)	0.032	0.007	0.03
	40	ND (5)	ND (0.005)	0.352	0.042	0.19
	50	12 (G)[b&d]	ND (1.3)	13.9	1.4	5.4
MW-11	10	ND (5)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.010)
	20	ND (5)	ND (0.005)	0.0072	ND (0.005)	ND (0.010)
	30	ND (5)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.010)
	40	ND (5)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.010)
	50	ND (5)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.010)

NOTES:

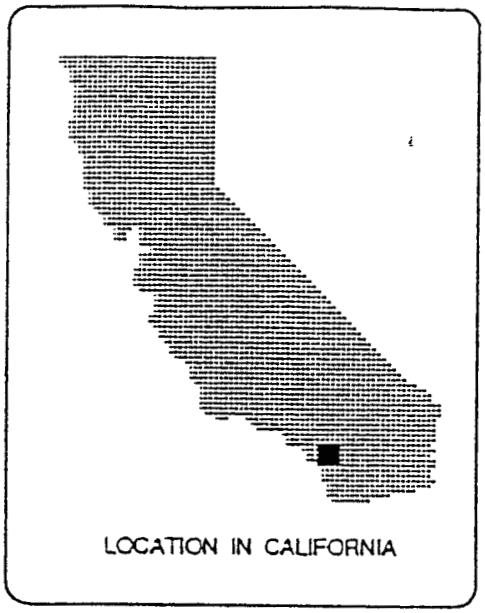
[a]bgs = below ground surface
[b](G) = denotes gasoline detected
(D) = denotes diesel detected
[c]ND (5) = not detected, value denotes detection limit concentration
[d] = the sample analyzed was non-homogeneous resulting in reported sum BTEX concentrations being greater than reported TVPH concentrations

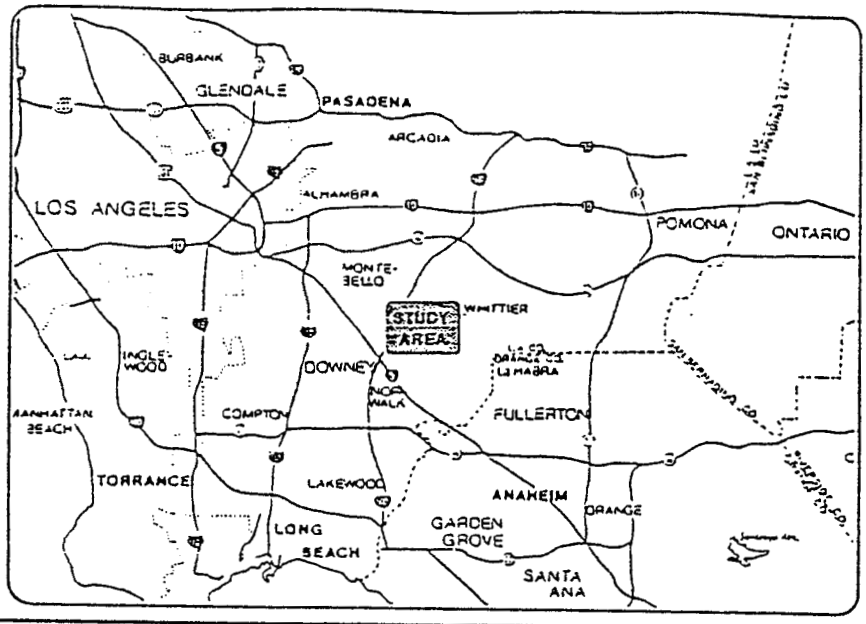
TABLE 3
REPORTED CHEMICAL RESULTS OF GROUNDWATER SAMPLES
VOLATILE AROMATIC HYDROCARBONS (U.S. EPA METHOD 8020),
SURFACTANTS (MBAS) (U.S. EPA METHOD 425.1)
AND pH (U.S. EPA METHOD 9040)
PILOT CHEMICAL COMPANY
Santa Fe Springs, California
Project 50-2219-02
July 1991

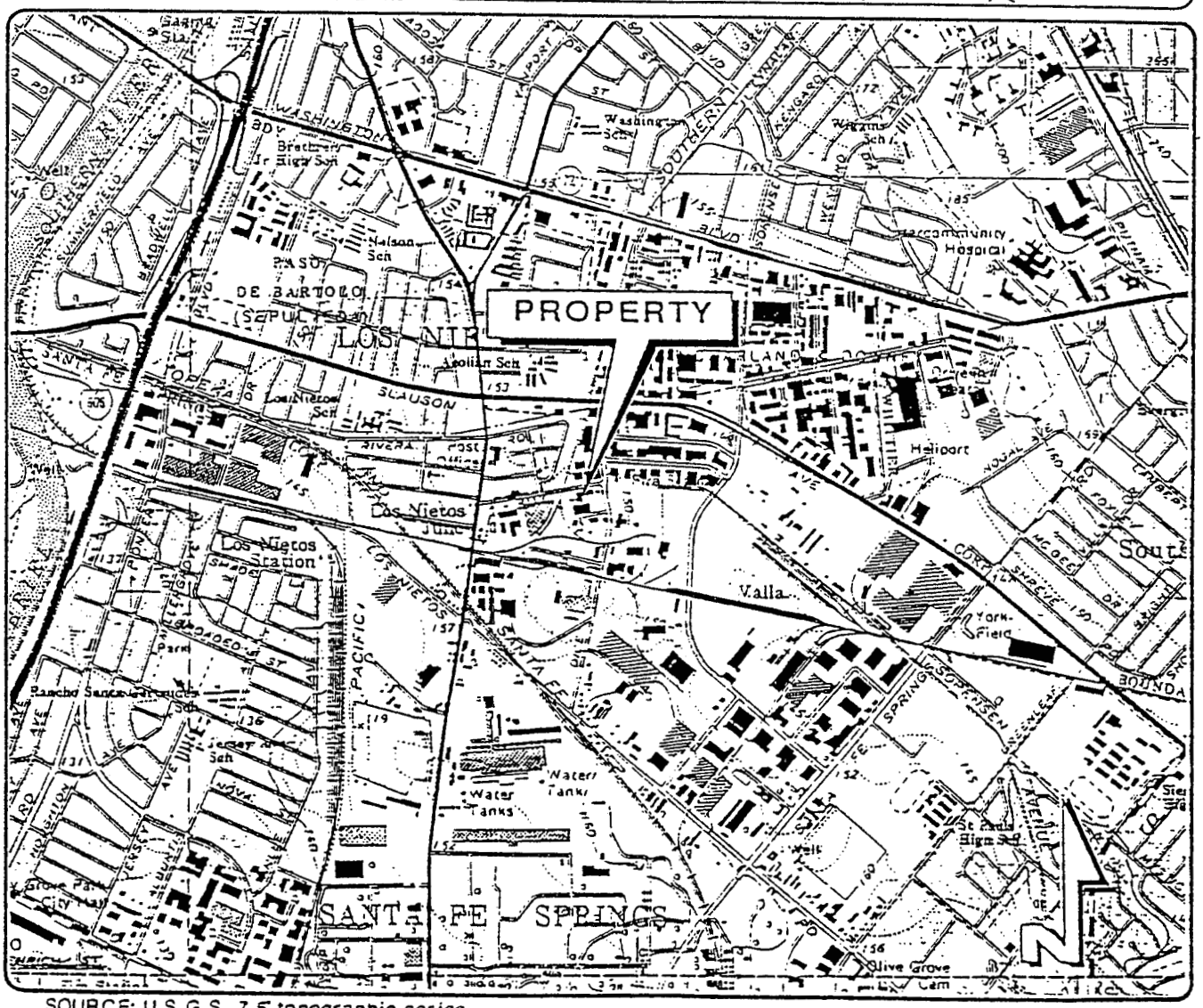
Well Number	pH (U.S. EPA Method 9040) (units)	Surfactants (MBAS) (U.S. EPA Method 425.1) (mg/l)[a]	Volatile Aromatic Hydrocarbon Compounds (U.S. EPA Method 8020) Benzene(B)	Ethyl-benzene(E)	Toluene(T)	Total Xylenes (X)
			Concentrations in micrograms per liter (µg/l)			
MW-1	7.39	0.8	ND (2,500)	3,600	18,000	12,000
MW-2	7.29	0.2	ND (500)	970	7,500	4,000
MW-3	7.17	2.0	ND (13,000)	14,000	110,000	52,000
MW-5	7.28	0.2	3.2	ND (0.5)	1.2	ND (1)
MW-6	7.27	ND (0.1)[b]	0.61	ND (0.5)	ND (0.5)	ND (1)
MW-7	7.44	ND (0.1)	ND	4.7	6.1	ND (4)
MW-8	7.20	ND (0.1)	ND	180	550	740
MW-9	7.54	0.1	4.8	2.7	2.3	33
MW-10	7.44	1.2	ND (10)	27	35	170
MW-11	7.39	2.2	ND (0.5)	0.95	1.0	7.6
TB01[c]	NA[d]	NA	ND (0.5)	ND (0.5)	ND (0.5)	ND (1)

NOTES:

[a]mg/l = concentrations in milligrams per liter
[b]ND(0.1) = not detected; value is the laboratory detection limit concentration
[c]TB01 = trip blank
[d]NA = not analyzed







SOURCE: U.S.G.S. 7.5' topographic series,
Whittier, California quadrangle

0' FEET 2,000

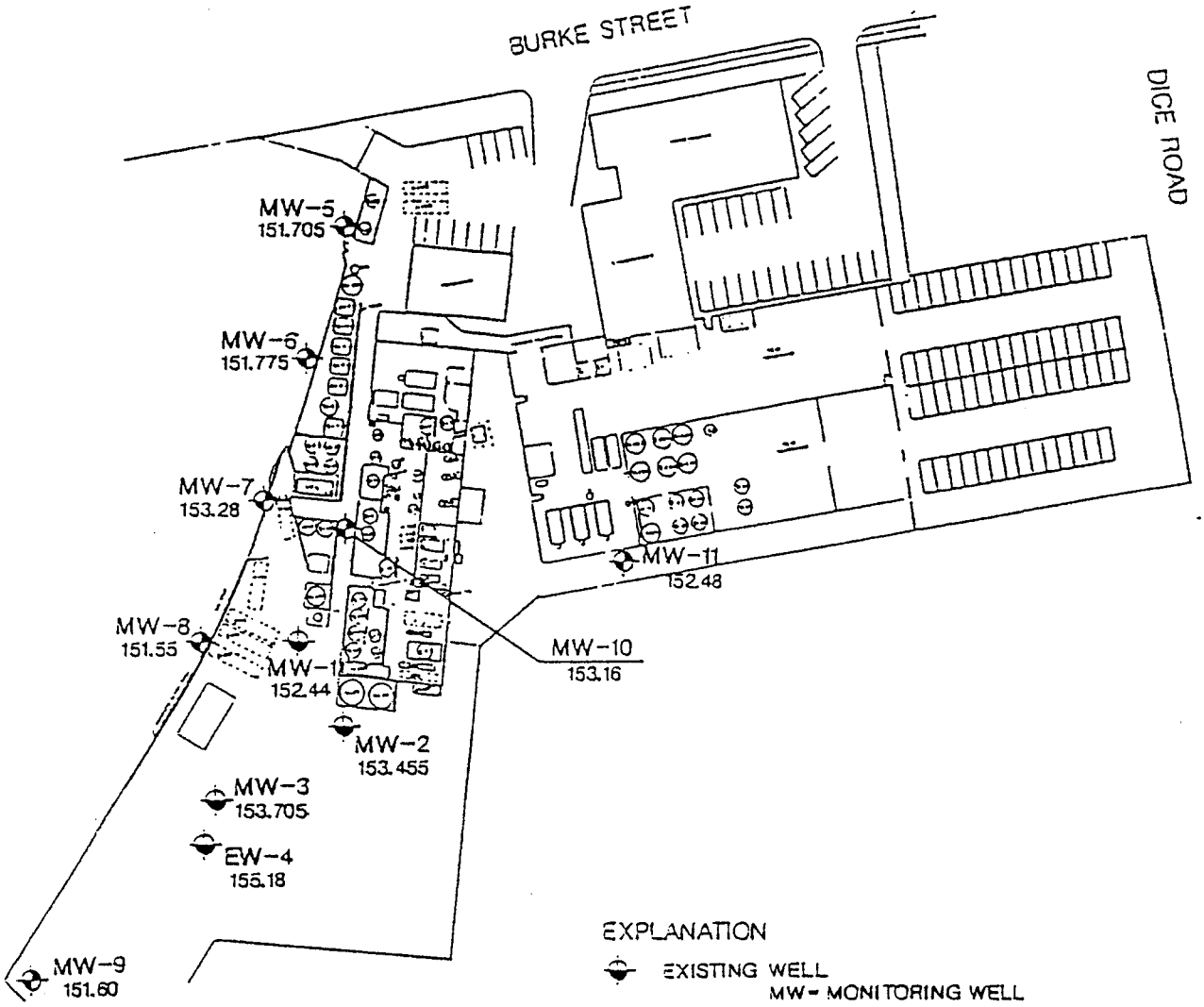
KLEINFELDER

PILOT CHEMICAL COMPANY
Santa Fe Springs, California

Project: 50-2219-02 July 1991

SITE LOCATION MAP

FIGURE
1



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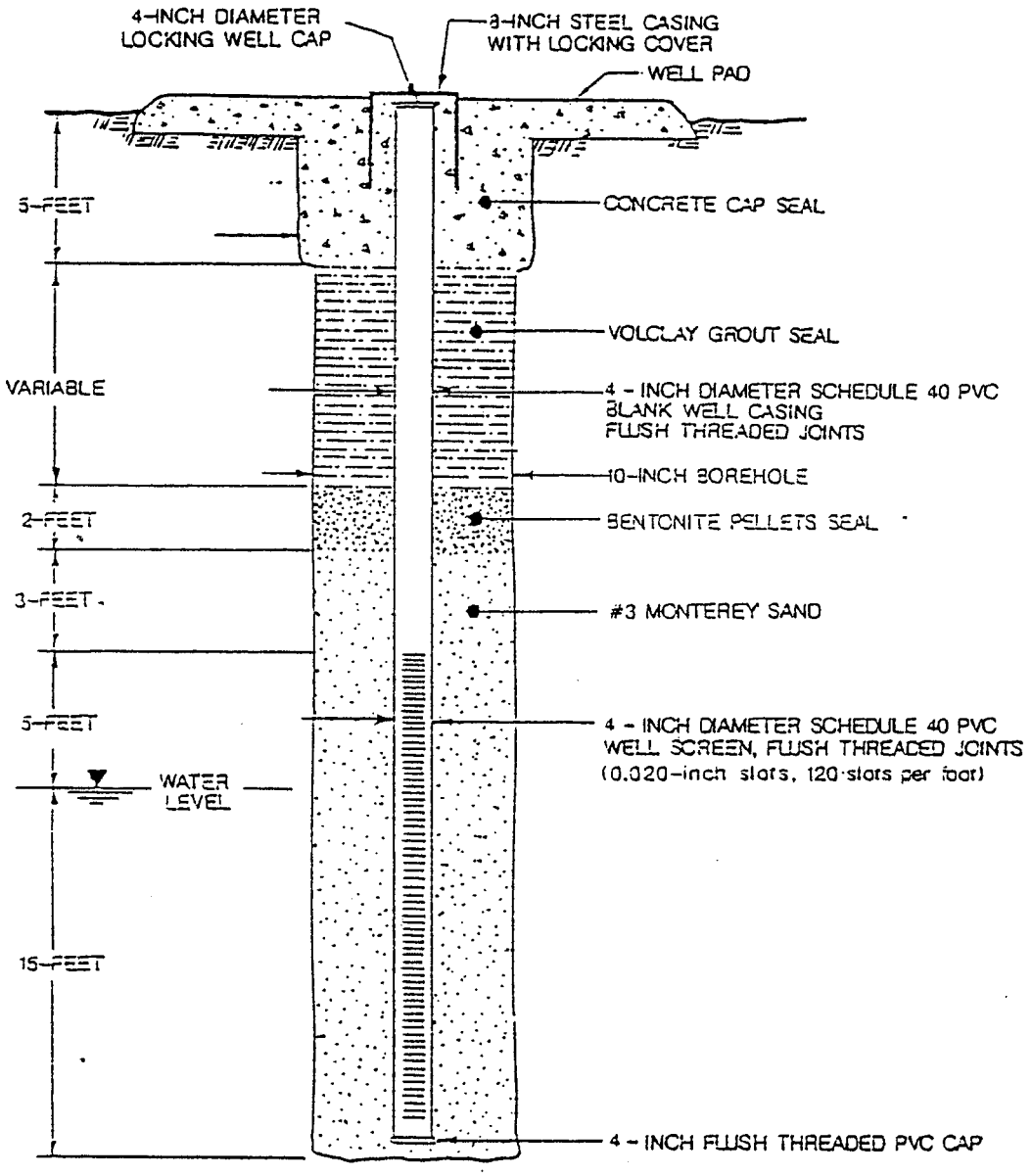
Santa Fe Springs, California

Project: 50-2219-02 July 1991

SITE MAP WITH GROUNDWATER MONITORING WELL LOCATIONS

FIGURE
2



NOT TO SCALE

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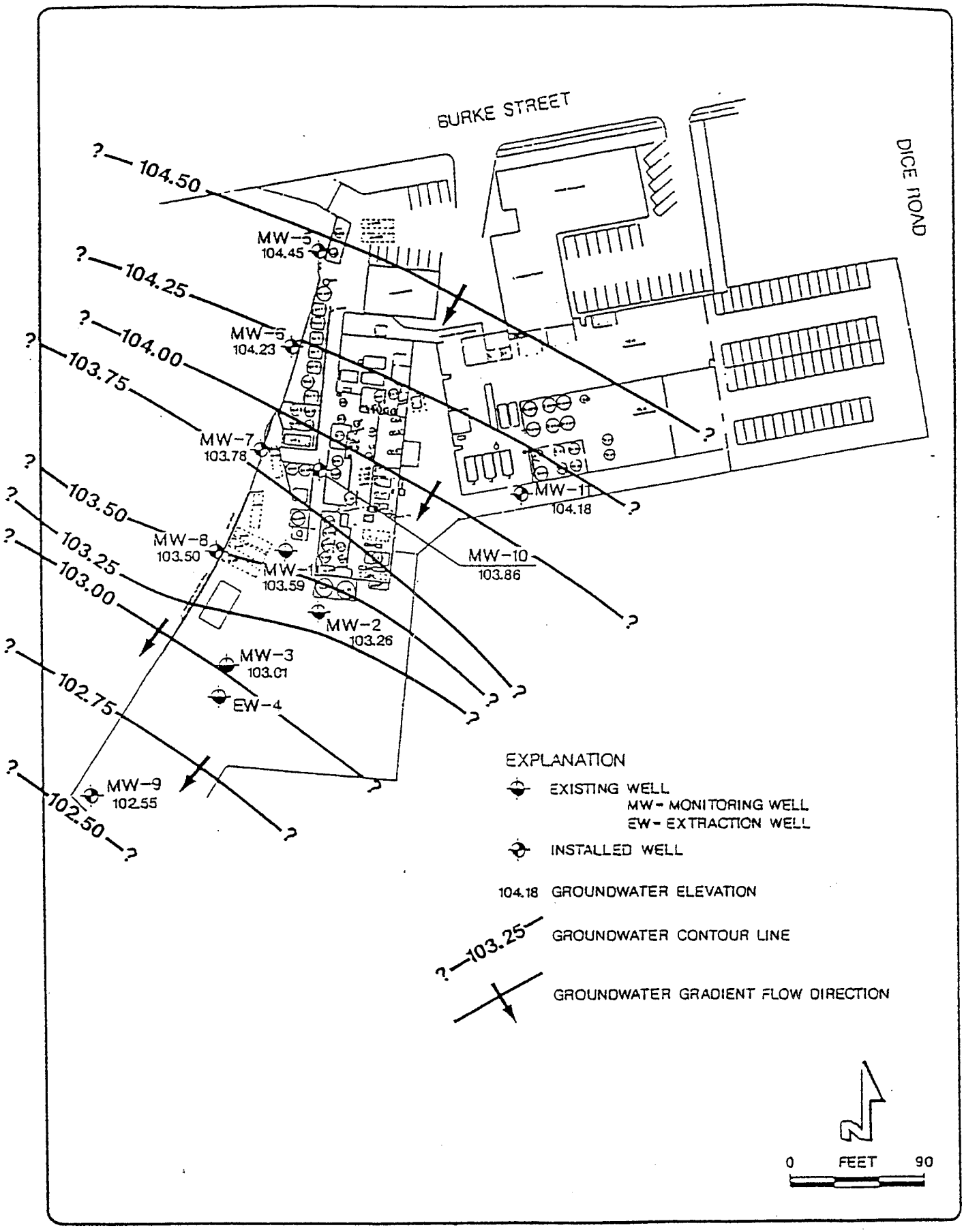
PILOT CHEMICAL COMPANY
Santa Fe Springs, California

Project: 50-2219-02 July 1991

TYPICAL GROUNDWATER MONITORING WELL CONSTRUCTION DETAIL

FIGURE
3



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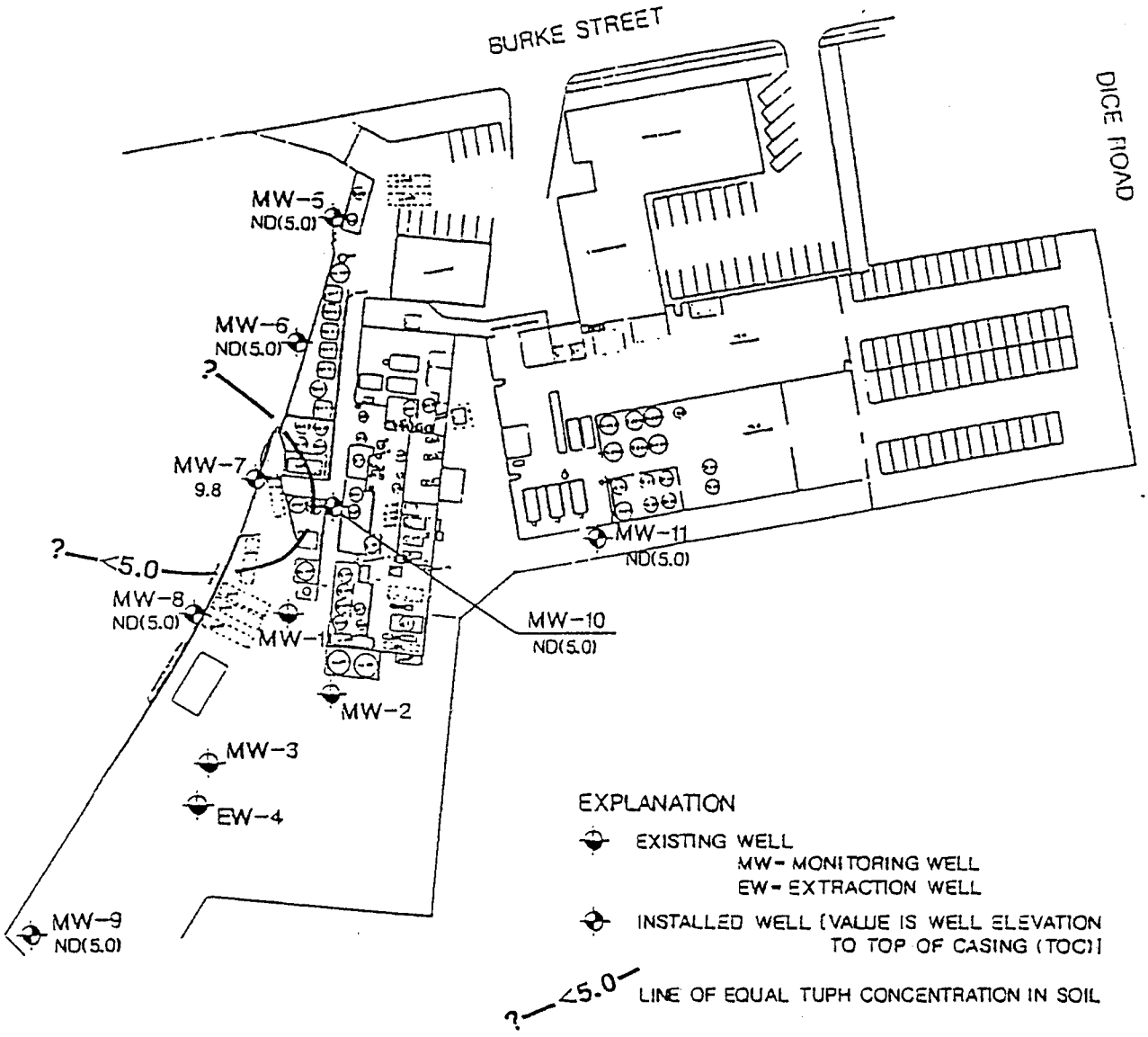
PILOT CHEMICAL COMPANY
Santa Fe Springs, California

Project: 50-2219-02 July 1991

GROUNDWATER GRADIENT MAP

FIGURE
4



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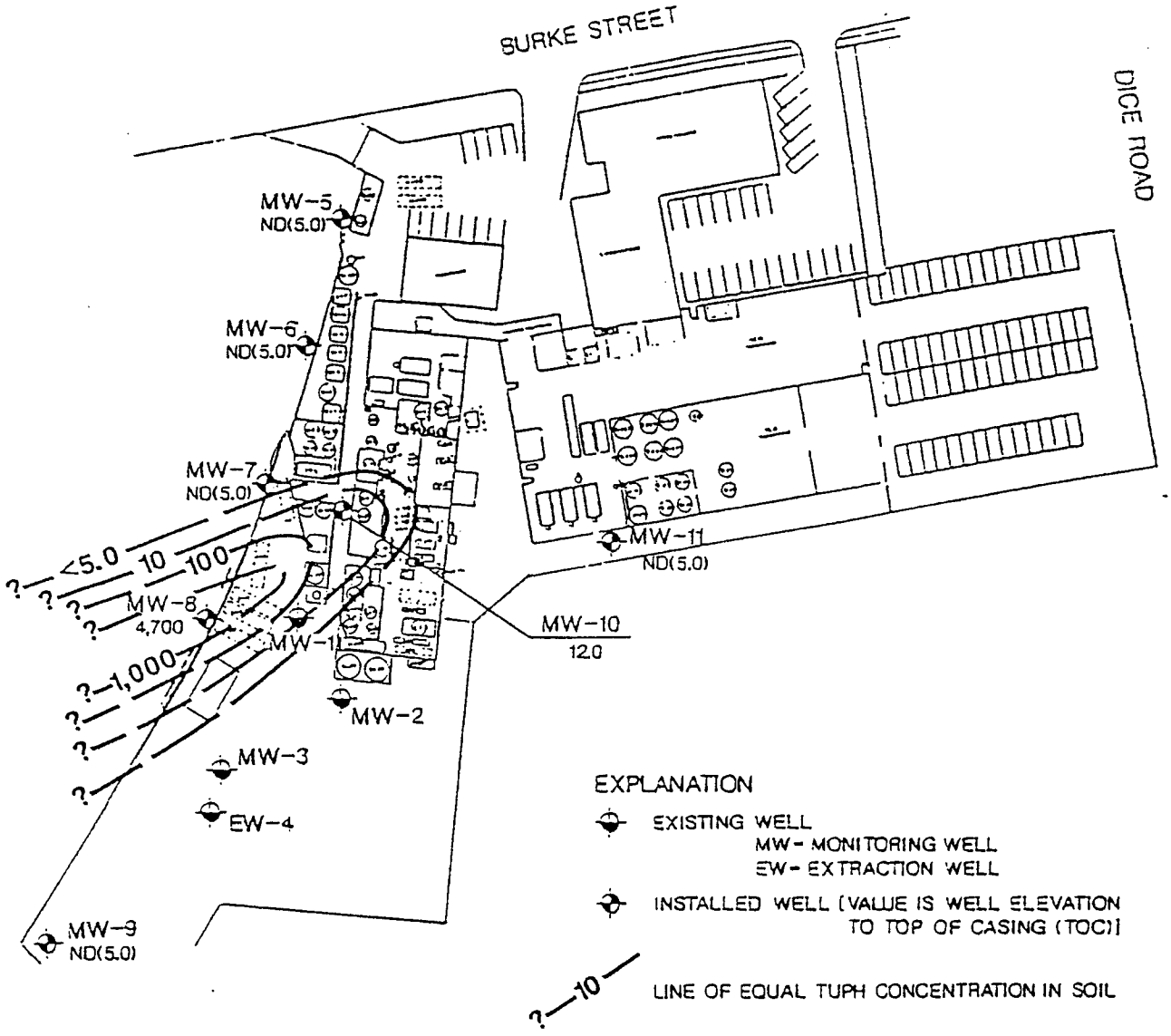
PILOT CHEMICAL COMPANY
Santa Fe Springs, California

Project: 50-2219-02 July 1991

TOTAL VOLATILE PETROLEUM HYDROCARBON COMPOUND CONCENTRATIONS IN SOIL AT 30 FEET BELOW GROUND SURFACE

FIGURE
5



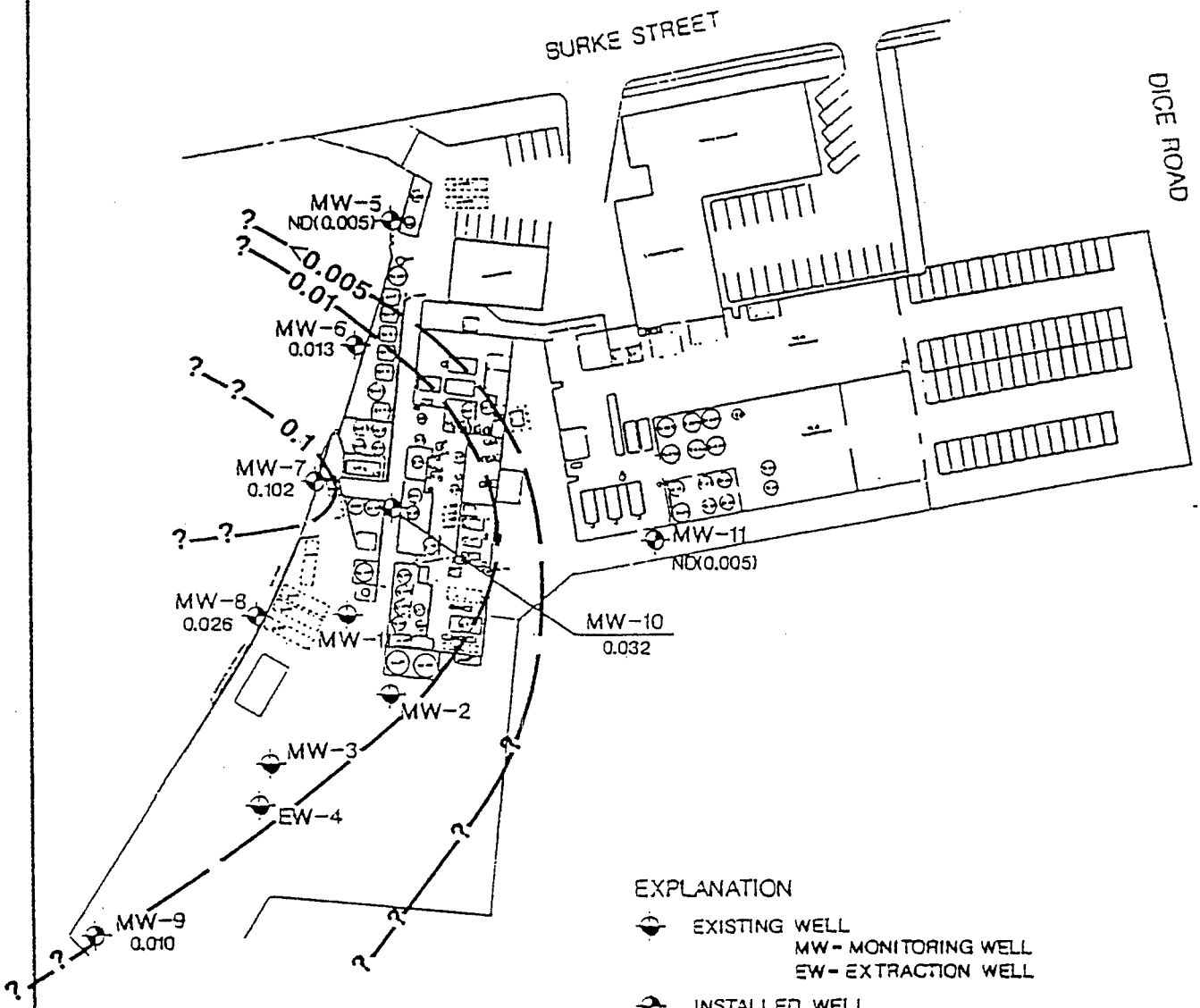
KLEINFELDER

PILOT CHEMICAL COMPANY
Santa Fe Springs, California

Project: 50-2219-02 July 1991

TOTAL VOLATILE PETROLEUM HYDROCARBON COMPOUND CONCENTRATIONS IN SOIL AT 50 FEET BELOW GROUND SURFACE

FIGURE
6



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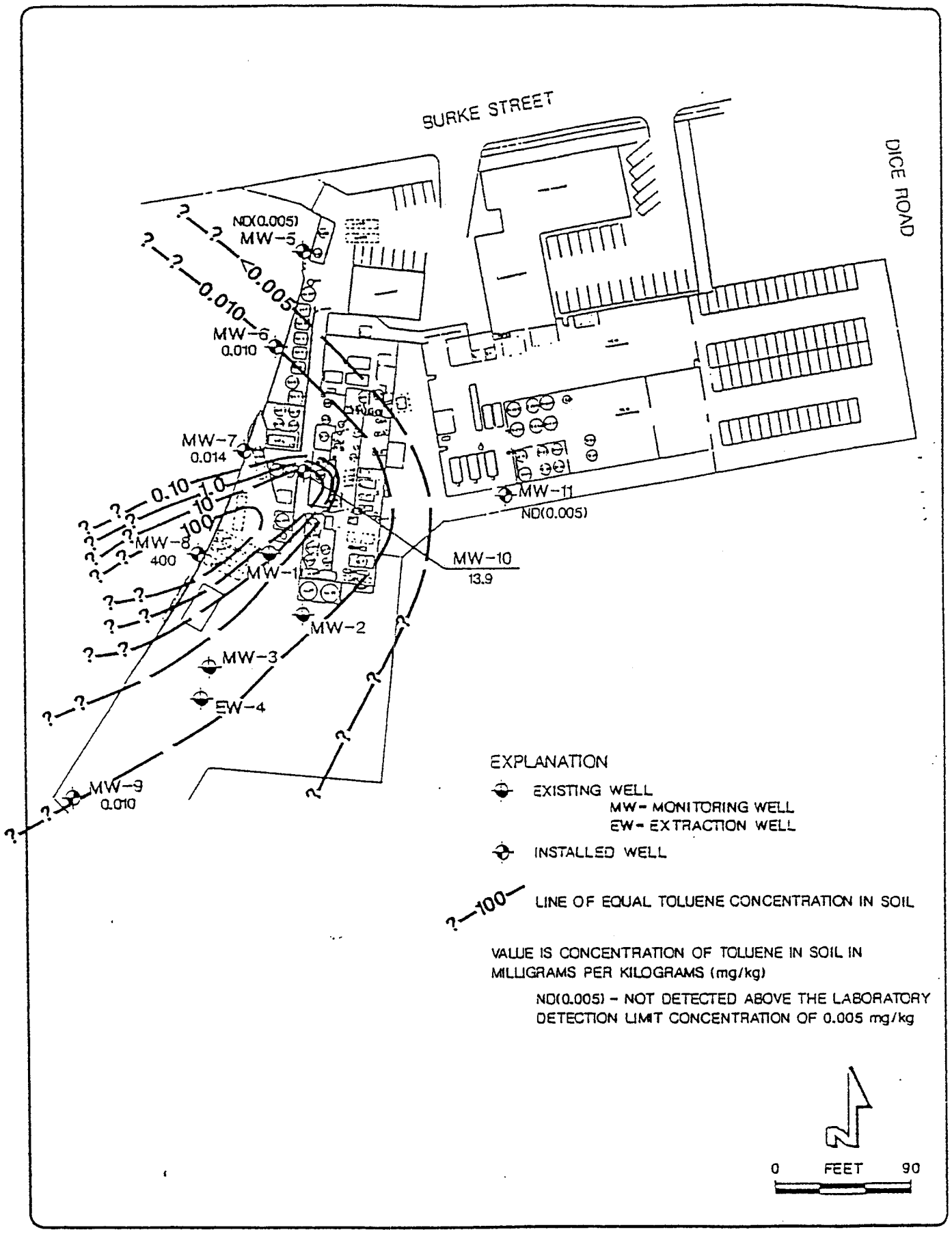
PILOT CHEMICAL COMPANY
Santa Fe Springs, California

Project: 50-2219-02 July 1991

TOLUENE CONCENTRATIONS IN SOIL AT 30 FEET BELOW GROUND SURFACE

FIGURE
7



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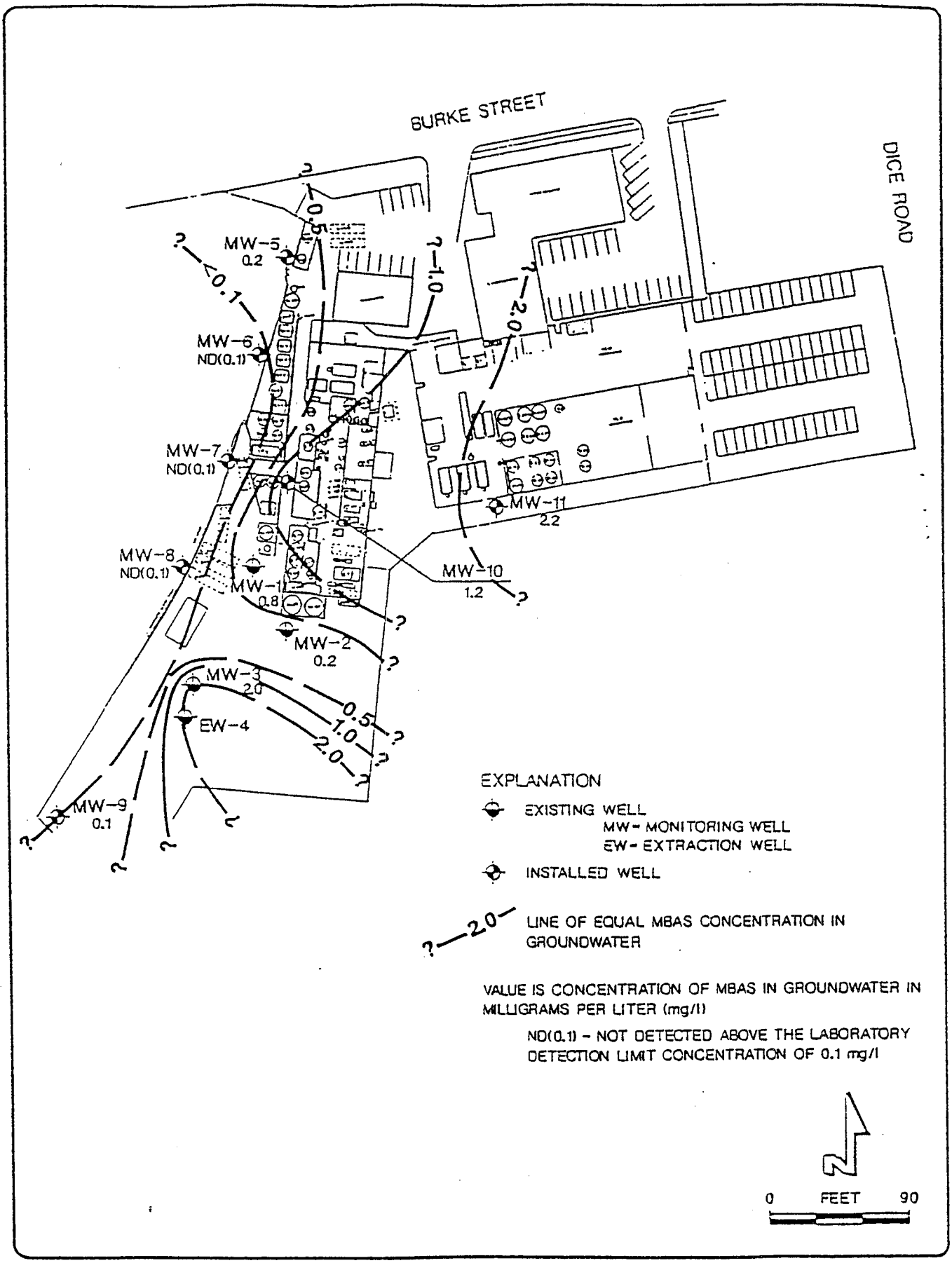
PILOT CHEMICAL COMPANY
Santa Fe Springs, California

Project: 50-2219-02 July 1991

TOLUENE CONCENTRATIONS IN SOIL AT 50 FEET BELOW GROUND SURFACE

FIGURE
8



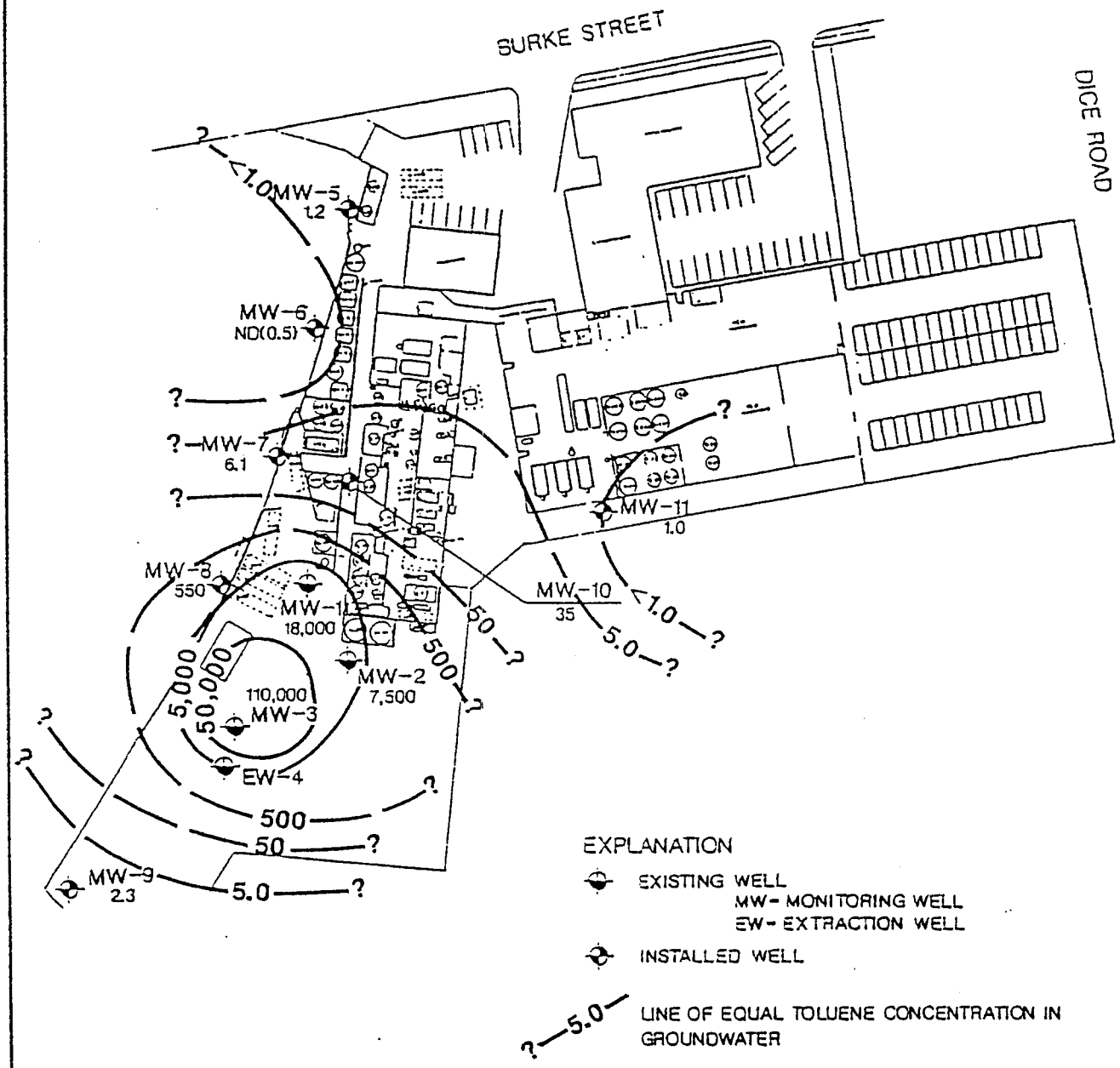
KLEINFELDER

PILOT CHEMICAL COMPANY
Santa Fe Springs, California

Project: 50-2219-02 July 1991

MBAS CONCENTRATIONS (milligrams per liter) IN GROUNDWATER

FIGURE
9



KLEINFELDER

PILOT CHEMICAL COMPANY
Santa Fe Springs, California

Project: 50-2219-02 July 1991

TOLUENE CONCENTRATIONS (micrograms per liter) IN GROUNDWATER

FIGURE
10

APPENDIX A

SOIL BORINGS AND FIELD LOGS

WELL CONSTRUCTION	CHEMICAL ANALYSES LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES LABORATORY TPH (mg/kg)	FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
Concrete & Flush Cristi With Locking Well Cap					0				GRADE GRAVEL: 6 inches thick.
Volclay Grout			0	42	5	05		SM	SILTY SAND: Fine, yellowish brown (10YR 5/6), medium dense, damp, no odor, slightly micaceous.
4" Schedule 40 PVC Well Casing	ND 0.005	ND 5	0	72	10	10		SM	SILTY SAND: Fine to medium, dark yellowish brown (10YR 3/6), very dense, damp, no odor, slightly micaceous.
			0	36	15	15		SP	SAND: Fine to medium, olive (5Y 5/3), medium dense, damp, no odor, subangular, slightly micaceous.
	T=0.008 ND 0.005	ND 5	0	48	20	20		SP	SAND: Fine to medium, olive (5Y 5/3), medium dense, damp, no odor, subangular, moderately micaceous.
					25				

SURFACE ELEVATION (feet): 151.60
TOTAL DEPTH (feet): 78.00
DATE DRILLED: 4-18-91

LOGGED BY: P. Stoppelmann
SUPERVISED BY: E. Trosper
DIAMETER of BORING: 10"
WATER ENCOUNTERED AT (feet): 57.00

KLEINFELDER

PROJECT NUMBER 50-2219-02 June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-5

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES LABORATORY TPH (mg/kg)	CHEMICAL ANALYSES FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE INTERVAL	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
			0	61	25		25		SP/SM	SAND: Fine to medium, with some fine gravel, olive (5Y 5/3), dense, damp, no odor, subangular grains, very micaceous.
									SW	GRAVELLY SAND: Fine to coarse sand and fine gravel, olive (5Y 5/3), dense, damp, no odor, subangular, highly micaceous.
	ND 0.005	ND 5	0	60	30		30			
			0	32	35		35		ML	CLAYEY SILT: Olive (5Y 4/3), medium dense, damp, no odor.
	ND 0.005	ND 5	0	32	40		40		ML	CLAYEY SILT: Olive (5Y 4/3), mottled with yellowish brown (10YR 5/6), medium dense, damp, no odor, slightly micaceous.
Bentonite Pellets			0	24	45		45		CL	CLAY: With trace of silt, olive (2.5Y 4/4), mottled with light olive brown (2.5Y 5/6), very stiff, moderately elastic, slightly micaceous.
	ND 0.005	ND 5	0	44	50		50		CL	SILTY CLAY: With trace of sand, dark reddish brown (5YR 3/4), hard, damp, no odor, slightly micaceous, slightly elastic.

KLEINFELDER

PROJECT NUMBER 50-2219-02 June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-5

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES LABORATORY TPH (mg/kg)	CHEMICAL ANALYSES FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE INTERVAL	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
#3 Sand Filter Pack					55				SW	SAND: Fine to coarse, with trace of silt, olive (5Y 4/4), dense, saturated, no odor, slightly micaceous.
4" Schedule 40 PVC 0.020" Machine Slotted Well Screen					60				SW	SAND: Fine to coarse, with trace of silt, olive (5Y 4/4), dense, saturated, no odor.
					65				SW	SAND: Fine to coarse, with trace of silt, olive (5Y 4/4), dense, saturated, no odor.
4" Schedule 40 PVC Threaded Bottom Plug					70				SW	SAND: Fine to coarse, with trace of silt, olive (5Y 4/4), dense, saturated, no odor.
Backfill					75				SW	SAND: Fine to coarse, with traces of silt, olive (5Y 4/4), dense, saturated, no odor.
					80					

KLEINFELDER

PROJECT NUMBER 50-2219-02

June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-5

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES LABORATORY TPH (mg/kg)	CHEMICAL ANALYSES FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE INTERVAL	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
Concrete & Flush Cristi With Locking Well Cap					0				af	GRADED GRAVEL
									SM	SILTY SAND: Medium to fine with some clay, dark yellowish brown (10YR 3/6), medium dense, damp, unknown odor, moderately micaceous, slightly elastic.
			0	20	5		05		SM	SILTY SAND: Medium to fine, dark yellowish brown (10YR 4/6), medium dense, damp, faint unknown odor, highly micaceous.
Volclay Grout	ND 0.005	ND 5	0	86	10		10		SM	SILTY SAND: Medium to fine, yellowish brown (10YR 5/4), very dense, damp, earthy odor, very highly micaceous, caliche present in soil sample.
			0	46	15		15		SM	SILTY SAND: Medium to fine, light yellowish brown (10YR 6/4), medium dense, damp, no odor, very highly micaceous.
									SW	SAND: In cuttings more abundant about 18 feet.
	T=0.010 ND 0.005	ND 5	27	47	20		20		SW	SAND: Coarse to fine with some fine gravel and trace of silt, light yellowish brown (10YR 6/4), dense, damp, moderately unknown odor, moderately micaceous, subangular to subrounded.
					25					

SURFACE ELEVATION (feet): 151.79
TOTAL DEPTH (feet): 76.00
DATE DRILLED: 4-10-91

LOGGED BY: R. Frizzell
SUPERVISED BY: E. Trosper
DIAMETER of BORING: 10"
WATER ENCOUNTERED AT (feet): 58.00

KLEINFELDER

PROJECT NUMBER 50-2219-02 June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-6

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES LABORATORY TPH (mg/kg)	FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
			0	75	25	25		SW	SAND: Coarse to medium with some fine gravel and trace of fine to silt, yellowish brown (10YR 5/4), very dense, damp, unknown odor, moderately micaceous, subangular to rounded.
4" Schdule 40 PVC Blank Well Casing	T=0.013 NO 0.005	ND 5	0	49	30	30		SP	GRAVEL PRESENT At 38 feet to 30 feet. GRAVELLY SAND: Coarse to medium, with fine gravel and some coarse gravel, dark grayish brown (2.5Y 4/2), dense, moist, earthy odor, slightly micaceous, subrounded to rounded, abundant detrital k-spar, angular to subangular, abundant silt chips.
								ML	CONTACT IN SHOE OF SAMPLER SILT: With some fine sand and clay, dark yellowish brown (10YR 4/4), dense, damp, unknown odor, very highly micaceous.
			0	32	35	35		ML	SILT: With trace of fine sand and clay, coarse gravel, olive gray (5Y 4/2), medium dense, damp, earthy odor, highly micaceous, angular to subangular.
	T=0.009 X=0.015 NO 0.005	ND 5	0	32	40	40		ML	SILT: With trace of fine sand to coarse gravel and clay, olive gray (5Y 4/2), medium dense, damp, earthy odor, very highly micaceous, subangular to subrounded.
				24	45	45		CH	CLAY: Dark yellowish brown (10YR 4/4), very dark grayish brown (2.5Y 3/2) mottled, very stiff, moist, no odor, very highly elastic.
					47				CUTTINGS ARE REDDISH At 47 feet.
Bentonite Pellets									
	T=0.010 NO 0.005	ND 5	0	50	50	50		ML	SILT: With some fine sand and trace of coarse to medium sand and clay, dark reddish brown (2.5YR 3/4), dense, damp, earthy odor, very highly micaceous, subrounded to round.

KLEINFELDER

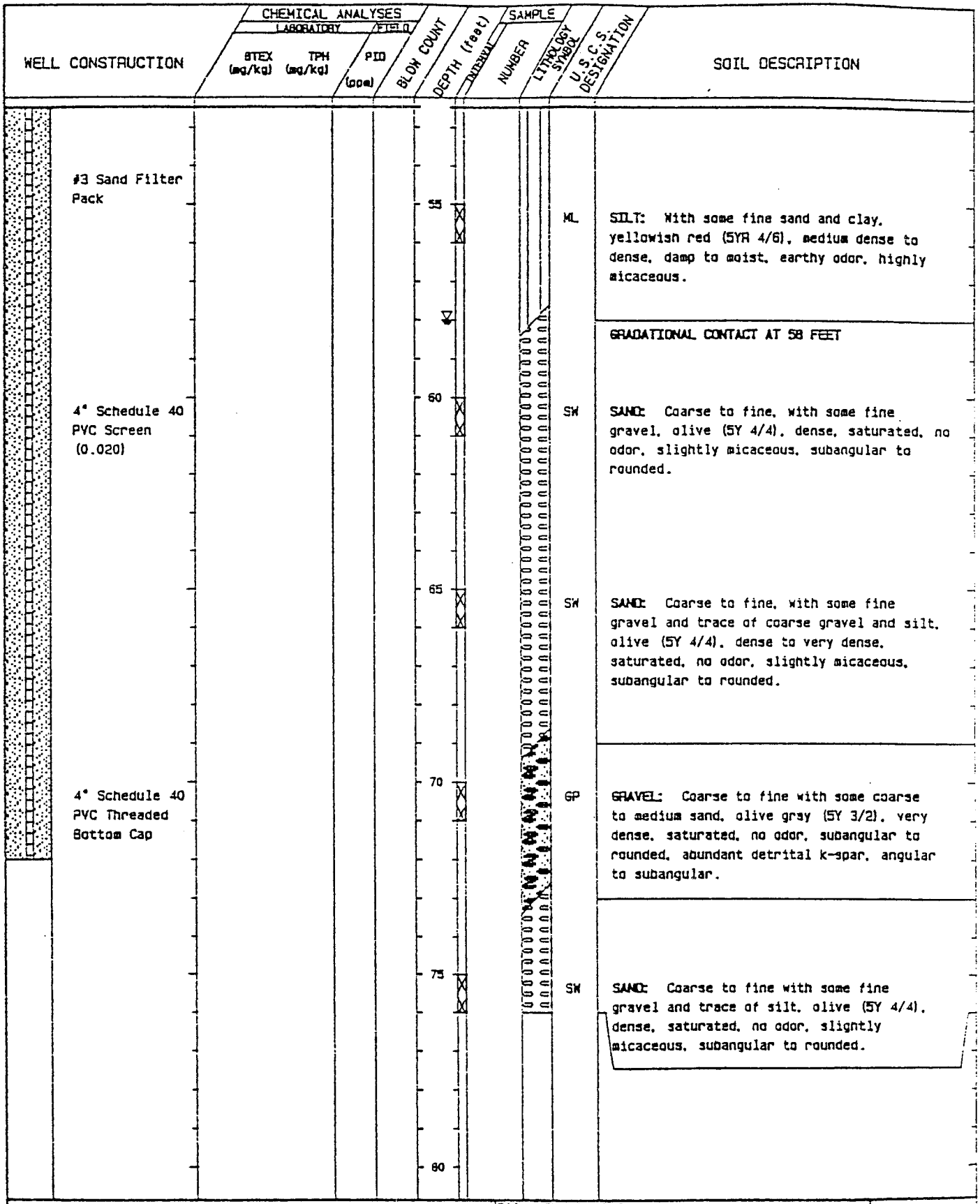
PROJECT NUMBER 50-2219-02

June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-6

FIGURE



KLEINFELDER

PROJECT NUMBER 50-2219-02

June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-6

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES LABORATORY TPH (mg/kg)	FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE INTERVAL	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
Concrete & Above Ground Monument With Locking Well Cap					0				af	ARTIFICIAL FILL: Cuttings are moist to saturated, very loose to loose.
					5				af	ARTIFICIAL FILL: No sample, cuttings are saturated, very loose to loose.
										Bottom of previous excavation at 9 feet
Volclay Grout	T=1.1 E=1.8 X=10 NO 0.005	59 0	193	56	10		10		SM	SILTY SAND: Medium to fine, very dark grayish brown (2.5Y 3/2), dense, damp, strong odor, highly micaceous.
			24	25	15		15		SM	SILTY SAND: Medium to fine, light olive brown (2.5Y 5/4), medium dense, damp, faint odor, highly micaceous. Cuttings become very sandy at 17 feet.
	T=0.043 X=0.043 NO 0.005	NO 5	10	54	20		20		SW	SAND: Medium to fine with some silt and trace of coarse yellowish brown (10YR 5/4), dense, damp, faint odor, highly micaceous.
					25					

SURFACE ELEVATION (feet): 151.89
TOTAL DEPTH (feet): 76.00
DATE DRILLED: 4-9-91

LOGGED BY: R. Frizzell
SUPERVISED BY: E. Trosper
DIAMETER of BORING: 10"
WATER ENCOUNTERED AT (feet): 58.00

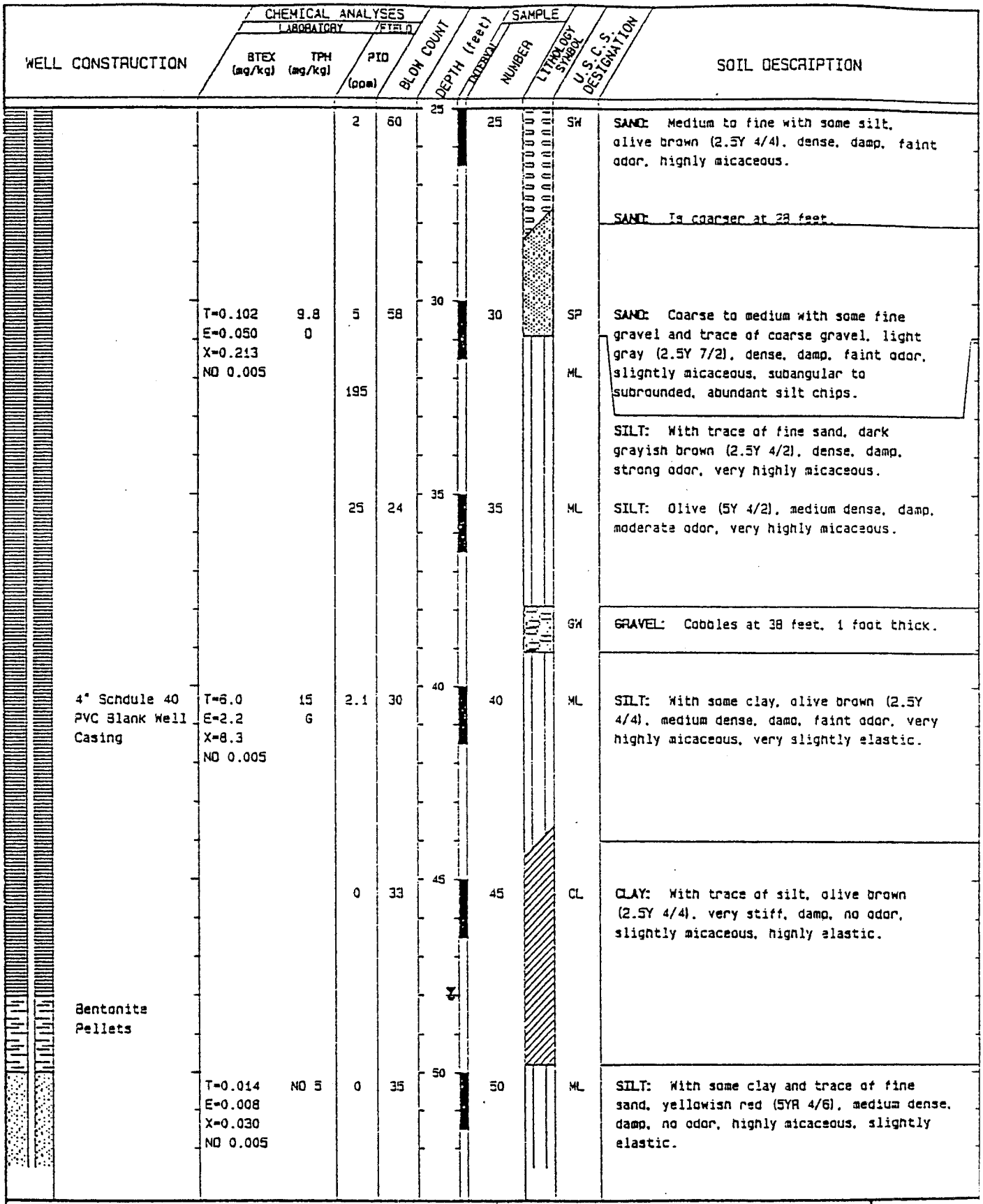
KLEINFELDER

PROJECT NUMBER 50-2219-02 June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-7

FIGURE



KLEINFELDER

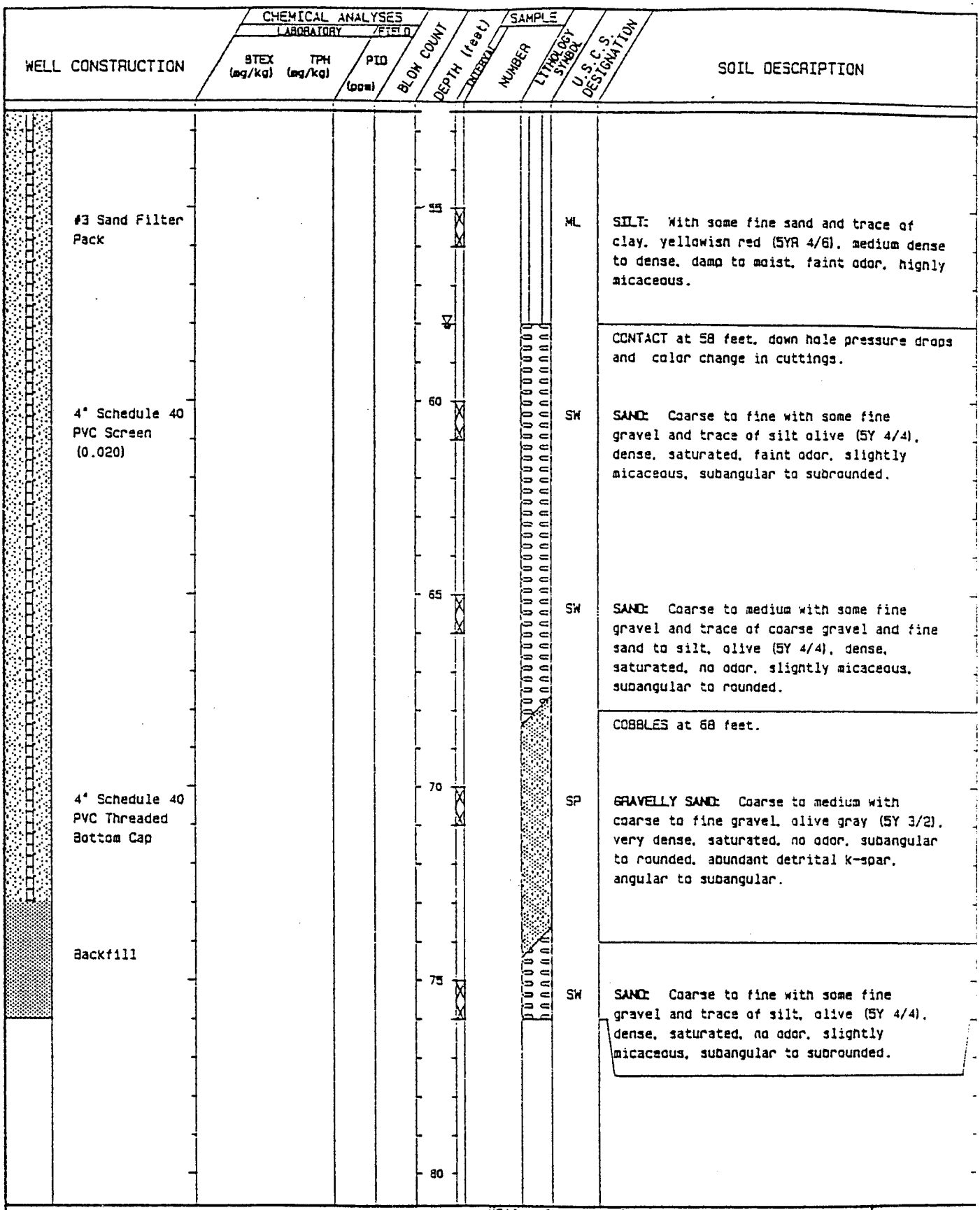
PROJECT NUMBER 50-2219-02

June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-7

FIGURE



KLEINFELDER

PROJECT NUMBER 50-2219-02

June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-7

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES LABORATORY STEX (mg/kg)	CHEMICAL ANALYSES LABORATORY TPH (mg/kg)	FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE INTERVAL	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
Concrete & Flush Cristi With Locking Well Cap					0			af		GRADED GRAVEL: 6 inches thick.
									SM	SILTY SAND: Medium to fine, reddish brown (5YR 4/4), medium dense, damp, no odor, highly micaceous.
			0	18	5		05		SM	SILTY SAND: Medium to fine, reddish brown (5YR 4/4), medium dense, damp, no odor, highly micaceous.
Volclay Grout	T=0.010 NO 5 NO 0.005		0	62	10		10		SM	SILTY SAND: Medium to fine, dark reddish brown (5YR 3/3), dense, damp, no odor, highly micaceous.
			0	43	15		15		SM	SILTY SAND: Medium to fine, light brownish gray (2.5Y 6/2), dense, damp, no odor, very highly micaceous.
	T=0.011 NO 5 X=0.011 NO 0.005		0	36	20		20		SW	SAND: Coarse to fine with some silt and trace of fine gravel, dark grayish brown (2.5Y 4/2), medium dense, damp, moderately micaceous, subrounded to round.
					25					

SURFACE ELEVATION (feet): 151.83
TOTAL DEPTH (feet): 76.00
DATE DRILLED: 4-8-91

LOGGED BY: A. Frizzell
SUPERVISED BY: E. Trosper
DIAMETER of BORING: 10"
WATER ENCOUNTERED AT (feet): 58.00

KLEINFELDER

PROJECT NUMBER 50-22:9-02 June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-8

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES LABORATORY TPH (mg/kg)	CHEMICAL ANALYSES FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE INTERVAL	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
			0	66	25		25		SW	SAND: Coarse to medium with some fine gravel and fine to silt, dark grayish brown (2.5Y 4/2), dense to very dense, damp, earthy odor, slightly micaceous, subangular to subrounded
										Gradational contact, gravel on augers.
	T=0.026 E=0.013 X=0.060	NO 5	0	44	30		30		SP	SAND: Coarse to medium with some fine gravel, dark grayish brown (2.5Y 4/2), dense, damp to moist, no odor, subangular to subrounded, silt chips.
	NO 0.005		0						ML	SILT: With trace of fine sand, olive gray (5Y 4/2), dense, damp, earthy odor, very highly micaceous.
4" Schedule 40 PVC Blank Well Casing			36	28	35		35		ML	SILT: Olive (5Y 4/2), medium dense, damp, faint odor, very highly micaceous.
										Contact is color change at 37 feet.
	T=33 E=63 X=86 NO 0.63	29 6	107	36	40		40		CL	SILTY CLAY: Dark grayish brown (2.5Y 4/2) and dark red (2.5YR 3/6), mottled, very stiff, strong odor, medium elastic, slightly micaceous.
			32	25	45		45		CL	SAND CATCHER USED CLAY: With trace of silt, dark yellowish brown (10YR 4/6), very stiff, moist, some odor, slightly micaceous, medium to highly elastic.
Bentonite Pellets	T=400 E=300 X=1000 NO 6.3	4,700 6	340	32	50		50		CL	SILTY CLAY: Dark reddish brown (5YR 3/4), very stiff, damp, very strong odor, moderately micaceous, moderately elastic.

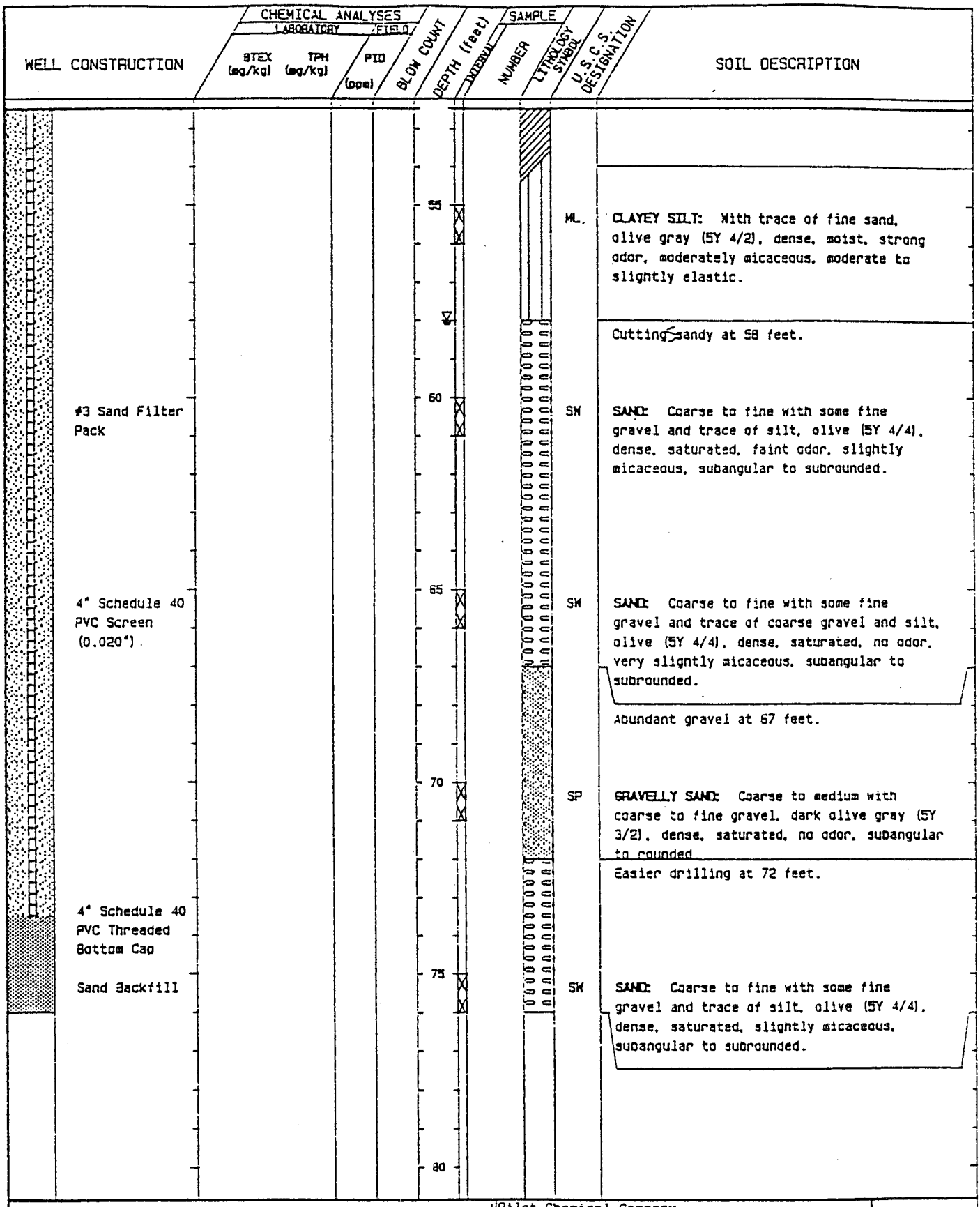
KLEINFELDER

PROJECT NUMBER 50-2219-02 June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-8

FIGURE



KLEINFELDER

PROJECT NUMBER 50-2219-02

June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-8

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES: LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES: LABORATORY TPH (mg/kg)	CHEMICAL ANALYSES: FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE: INTERVAL	SAMPLE: NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
Concrete With Above Ground Monument & Locking Well Cap					0				af	Surface is silt and sand with concrete debris to 2 feet.
			0	38	5		05		ML	SILT: With some medium to fine sand, dark reddish brown (2.5YR 3/4), dense, damp, no odor, moderately micaceous.
										Cuttings sandy.
Volclay Grout	T=0.009 NO 0.005	NO 5	0	7	10		10		SW	SAND: Medium to fine with some coarse and silt, strong brown (7.5YR 4/6), loose, damp, no odor, moderately micaceous.
			0	24	15		15		SW	SAND: Medium to fine with some fine gravel to coarse, light brown (7.5YR 6/4), medium dense, damp, no odor, moderately micaceous, subangular to rounded.
	T=0.010 NO 0.005	NO 5	0	33	20		20		SW	SAND: Medium to fine with some coarse and silt, brown (10YR 5/3), medium dense, damp, no odor, moderate to highly micaceous.
					25					

SURFACE ELEVATION (feet): 151.03
TOTAL DEPTH (feet): 76.00
DATE DRILLED: 4-3-91

LOGGED BY: A. Frizzell
SUPERVISED BY: E. Trosper
DIAMETER of BORING: 10"
WATER ENCOUNTERED AT (feet): 54.50

KLEINFELDER

PROJECT NUMBER 50-2219-02 June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-9

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES LABORATORY TPH (mg/kg)	FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
			0	64	25	25		SW	SAND: Coarse to fine with some fine gravel, brownish yellow (10YR 6/6), dense to very dense, damp, no odor, slightly micaceous, subangular to rounded.
								GP	GRAVEL: Coarse to fine with some coarse sand.
	T=0.010 ND 0.005	ND 5	0	44	30	30		ML	SILT: With trace of fine sand, yellowish brown (10YR 5/6), dense, damp, no odor, very highly micaceous.
									Downhole pressure jumps between 33 feet and 34 feet.
			0	35	35	35		ML	SILT: With trace of fine sand, yellowish brown (10YR 5/6), dense, damp, no odor, very highly micaceous.
									Clay balls at 38 feet.
4" Schedule 40 PVC Blank Well Casing	T=0.010 ND 0.005	ND 5	0	37	40	40		CL	SILTY CLAY: With trace of fine sand, dark yellowish brown (10YR 4/6), very stiff, damp, no odor, moderately micaceous.
			0	29	45	45		CL	CLAY: With some fine sand to silt, dark yellowish brown (10YR 4/6), very stiff, damp to moist, no odor, highly micaceous.
Bentonite Pellets	T=0.010 X=0.02 ND 0.005	ND 5	0	36	50	50		CL	SILTY CLAY: With trace of fine sand, brown to dark brown (7.5YR 4/4), very stiff, damp to moist, no odor, very highly micaceous.

KLEINFELDER

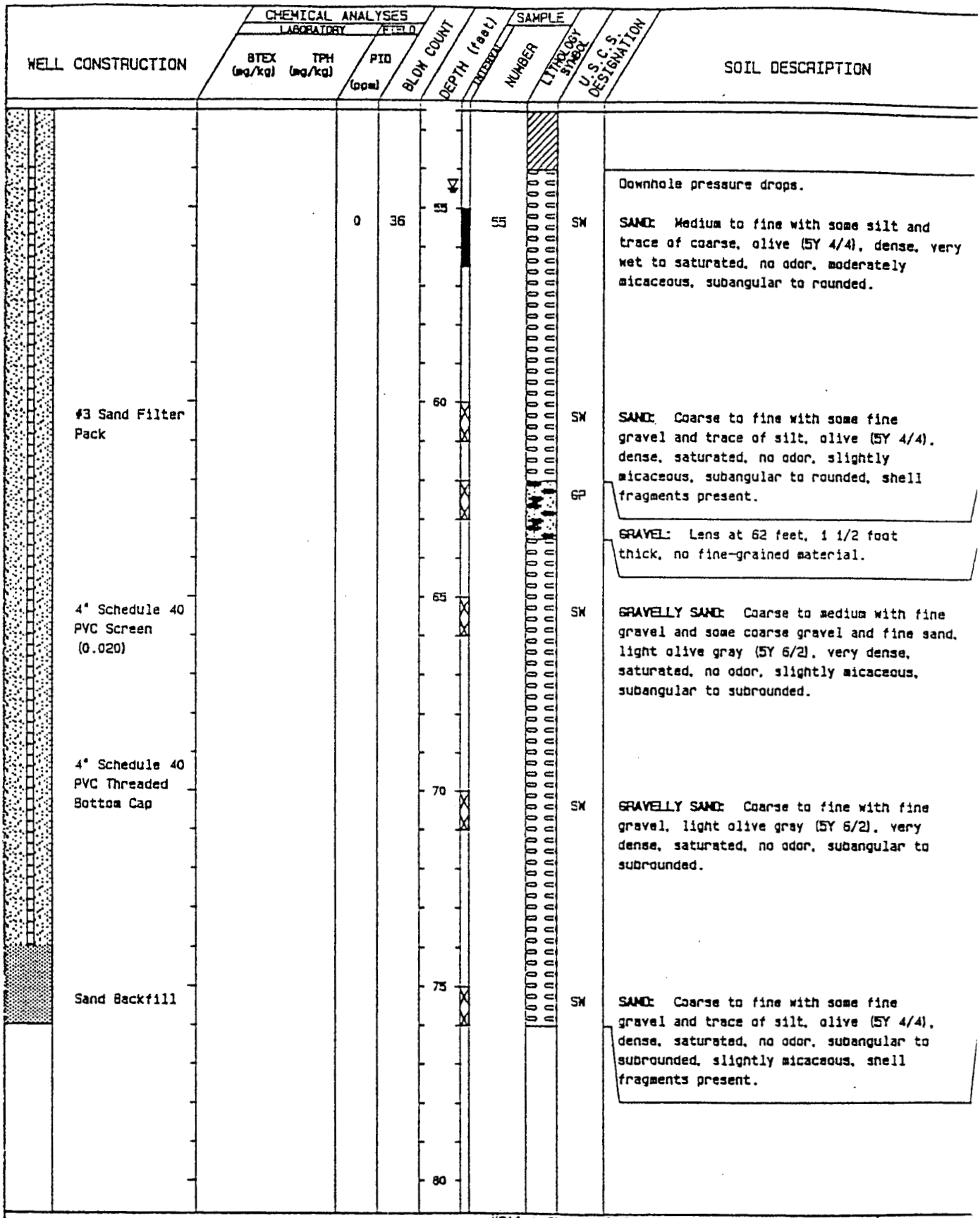
PROJECT NUMBER 50-2219-02

June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-9

FIGURE



KLEINFELDER

PROJECT NUMBER 50-2219-02

June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-9

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES LABORATORY TPH (mg/kg)	CHEMICAL ANALYSES FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
Concrete With Flush Cristi & Locking Well Cap					0				CONCRETE Equals 6 inches.
								CL	CLAY: with trace of silt, reddish brown (2.5YR 4/4), grayish brown (2.5Y 5/2) and black (5Y 2.5/1), mottled, stiff to very stiff, damp, strong odor, moderate to highly elastic.
			7	27	5	05		SM	Contact, sandier and color change. SILTY SAND: Medium to fine, dark brown (7.5YR 3/4), medium dense, damp, faint odor, highly micaceous.
Volclay Grout	T=0.688 E=0.057 X=0.24 NO 0.005	NO 5	48	77	10	10		SM	SILTY SAND: Medium to fine, brownish yellow (10YR 6/6), very dense, damp, moderate odor, highly micaceous.
			71	45	15	15		SM	SILTY SAND: Medium to fine, brownish yellow (10YR 6/6), dense, damp, moderate odor, highly micaceous.
	T=0.007 E=0.043 X=0.03 NO 0.005	NO 5	215	50	20	20		SW	SAND: Medium to fine with some coarse and trace of silt, very pale brown (10YR 7/4), very dense, damp, strong odor, highly micaceous.
					25				

SURFACE ELEVATION (feet): 153.45
TOTAL DEPTH (feet): 76.50
DATE DRILLED: 4-5-91

LOGGED BY: R. Frizzell
SUPERVISED BY: E. Trosper
DIAMETER of BORING: 10"
WATER ENCOUNTERED AT (feet): 58.00

KLEINFELDER

PROJECT NUMBER 50-2219-02 June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-10

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES – LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES – LABORATORY TPH (mg/kg)	CHEMICAL ANALYSES – FIELD PID (ppm)	BLOW COUNT	DEPTH (feet)	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
			75	69	25	25		SW	SAND: Medium to fine with some silt, very pale brown (10YR 7/4), very dense, damp, moderate odor, highly micaceous.
								GW	GRAVEL: Coarse to fine at 28 feet, 6 inches thick, subangular to subrounded.
4" Schedule 40 PVC Blank Well Casing	T=0.032 E=0.007 X=0.03 ND 0.005	ND 5	45	53	30	30		SW	SAND: Coarse to fine with trace of fine gravel and silt, very pale brown (10YR 7/4), dense, damp, moderate odor, very highly micaceous, subangular to subrounded.
									Contact, downhole pressure increases.
			270	60	35	35		ML	SILT: With some medium to fine sand and trace of clay, light olive brown (2.5Y 5/4), dense, damp, moderate to strong odor, highly micaceous, slightly elastic.
									Contact gradational
	T=0.352 E=0.042 X=0.19 ND 0.005	ND 5	350	60	40	40		CL	CLAY: With trace of silt, light olive brown (2.5Y 5/6), hard damp, strong odor, slightly micaceous, moderately elastic.
								ML	Silt cuttings
								CL	Clay, clayballs.
			65	40	45	45		ML	SILT: Dark yellowish brown (10YR 4/6), medium dense to dense, damp, faint odor, very highly micaceous, non-elastic.
Bentonite Pellets									
	T=13.9 E=1.4 X=5.4 ND 0.005	12 6	10	46	50	50		CL	SILTY CLAY: With trace of fine sand, dark reddish brown (2.5YR 3/4), dark grayish brown (10YR 4/2), mottled, hard, damp, faint odor, moderately micaceous, moderately elastic, clays are expansive (difficult to

KLEINFELDER

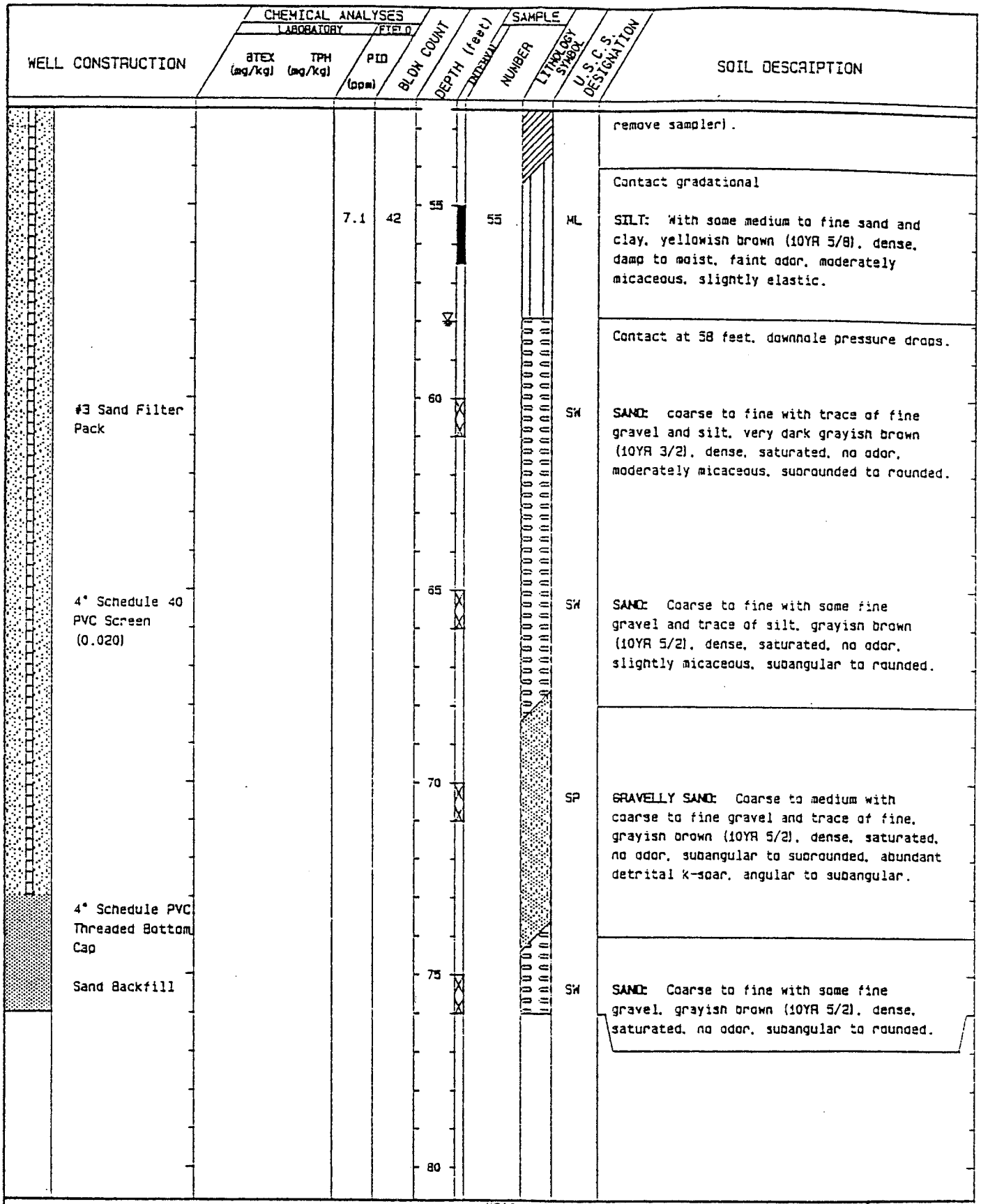
PROJECT NUMBER 50-2219-02

June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-10

FIGURE



KLEINFELDER

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June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-10

FIGURE

WELL CONSTRUCTION	CHEMICAL ANALYSES LABORATORY BTEX (mg/kg)	CHEMICAL ANALYSES LABORATORY TPH (mg/kg)	CHEMICAL ANALYSES FIELD PID (ppm)	BLOW COUNT	DEPTH (feet) BELOW	SAMPLE NUMBER	LITHOLOGY SYMBOL	U.S.C.S. DESIGNATION	SOIL DESCRIPTION
					0				ASPHALT Equals 6 inches thick.
Concrete With Flush Cristi & Locking Well Caps								af	ARTIFICIAL FILL: Sand and gravel, olive gray.
									CONCRETE: Equals 4 inches thick.
			0	22	5	05		SM	SILTY SAND: Medium to fine, dark yellowish brown (10YR 4/6), medium dense, damp, earthy odor, highly micaceous.
Volclay Grout	ND 0.005	ND 5	0	80	10	10		SM	SILTY SAND: Medium to fine, pale brown (10YR 6/3), very dense, damp, earthy odor, very highly micaceous.
			0	80	15	15		SM	SILTY SAND: Medium to fine with some fine gravel, pale brown (10YR 6/3), very dense, damp, no odor, very highly micaceous.
	T=0.0072 ND 0.005	ND 5	0	34	20	20		SM	SILTY SAND: Medium to fine, dark yellowish brown (10YR 3/4) and light brownish gray (2.5Y 6/2), mottled, medium dense, damp, no odor, very highly micaceous.
					25				

SURFACE ELEVATION (feet): 152.78
TOTAL DEPTH (feet): 76.50
DATE DRILLED: 4-11-91

LOGGED BY: A. Frizzell
SUPERVISED BY: E. Trosper
DIAMETER of BORING: 10"
WATER ENCOUNTERED AT (feet): 57.00

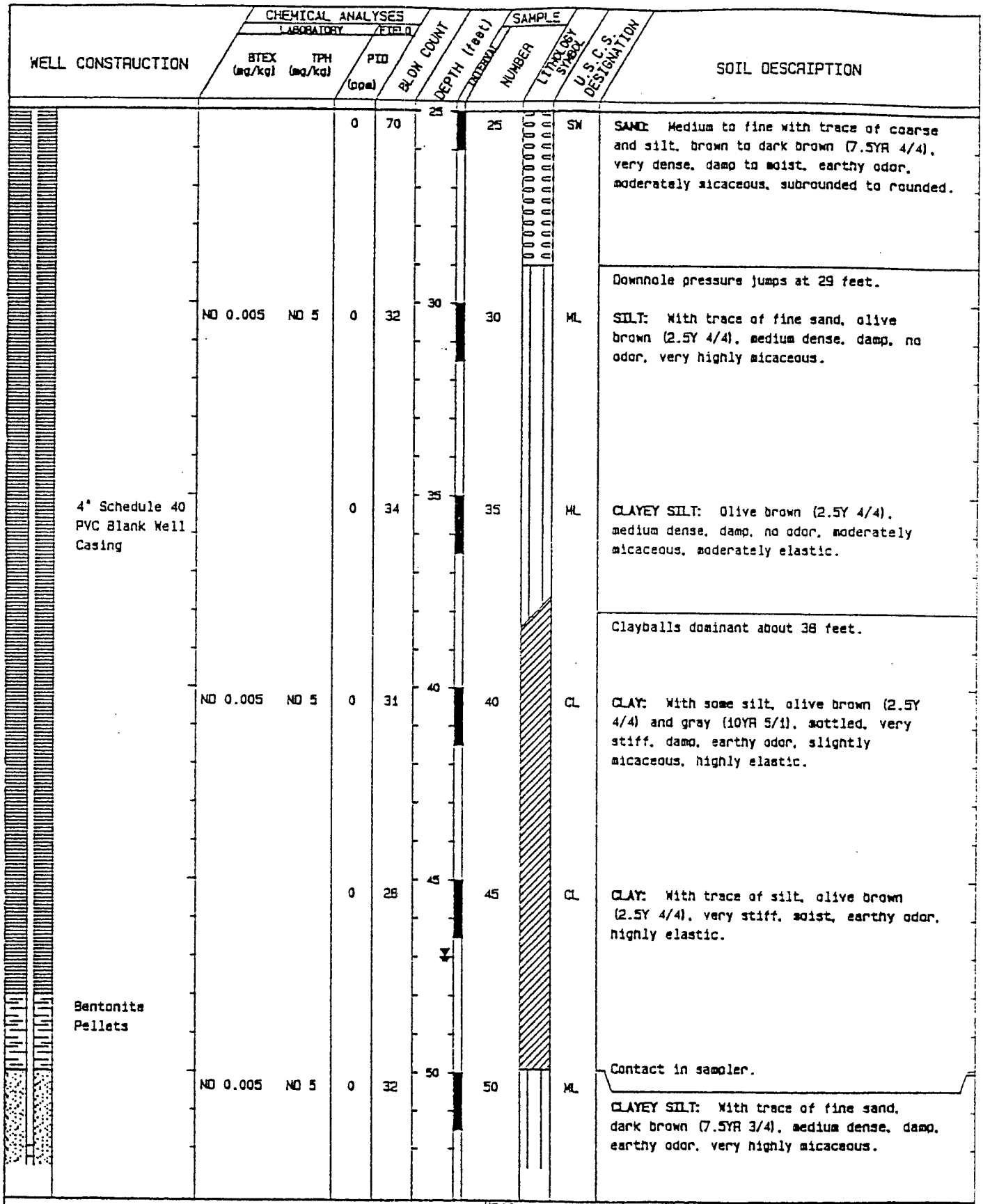
KLEINFELDER

PROJECT NUMBER 50-2219-02 June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-11

FIGURE



KLEINFELDER

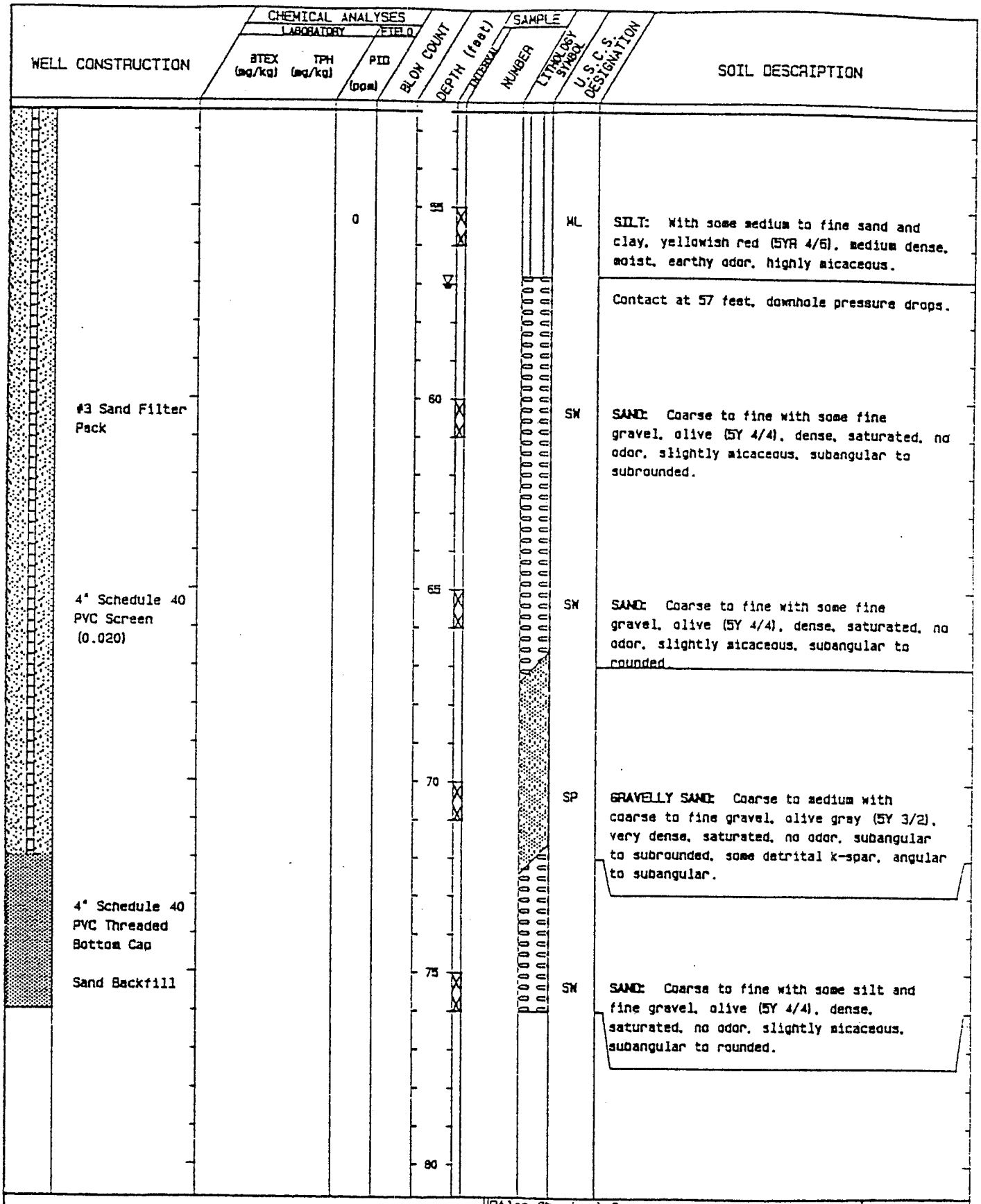
PROJECT NUMBER 50-2219-02

June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-11

FIGURE



KLEINFELDER

PROJECT NUMBER 50-2219-02

June 1991

Pilot Chemical Company
Santa Fe Springs, California

LOG of BORING MW-11

FIGURE

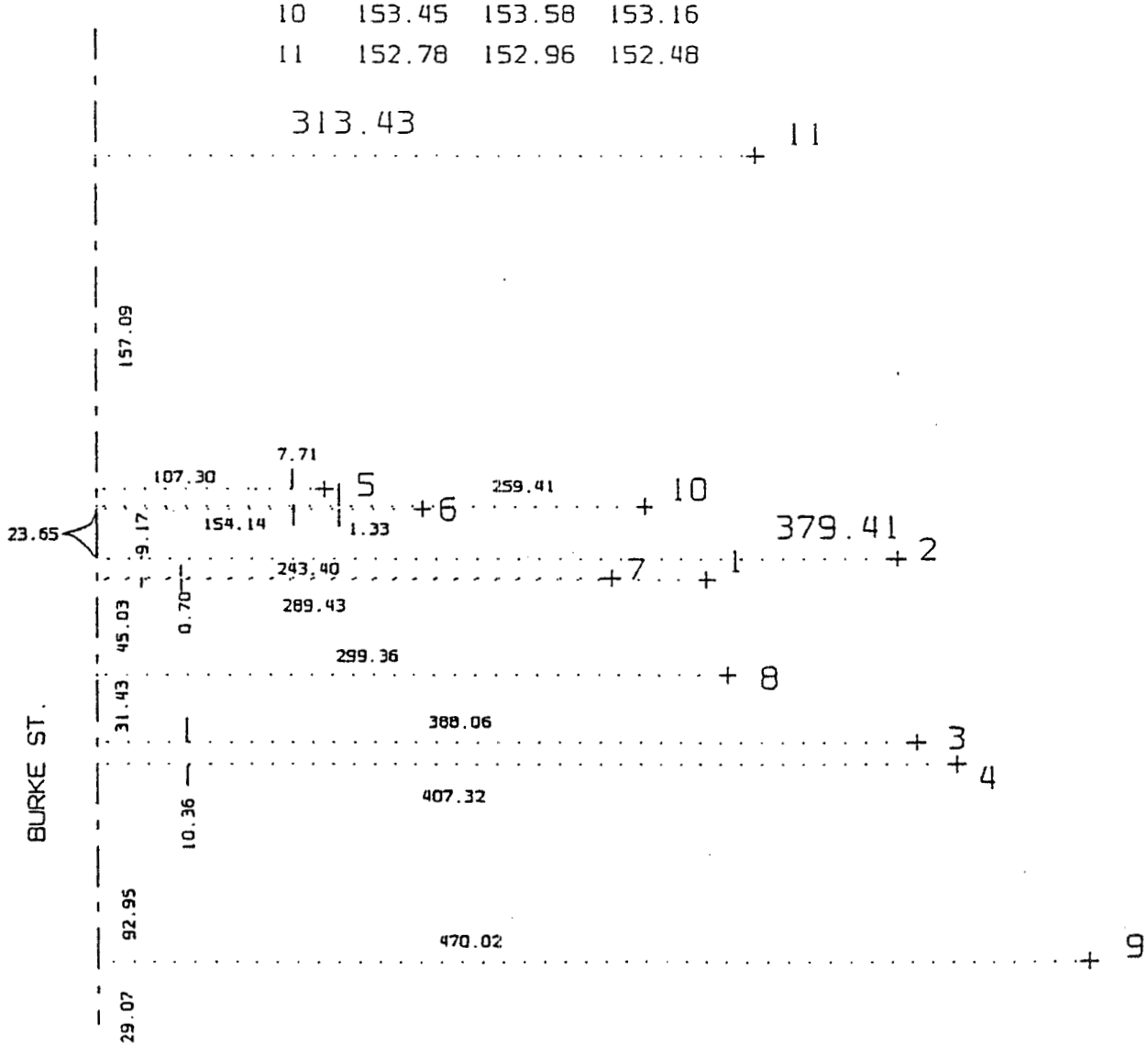
PILOT CHEMICAL CO.

11756 BURKE ST.

SANTA FE SPRINGS

		DIRT	RIM	PIPE
WELL NO.	1	152.6	152.85	152.44
	2	152.54	153.75	153.455
	3	153.56	154.065	153.705
	4	153.43	155.64	155.18
	5	151.60	152.05	151.705
	6	151.79	151.995	151.775
	7	151.89	153.53	153.28
	8	151.83	151.93	151.55
	9	151.03	151.86	151.60
	10	153.45	153.58	153.16
	11	152.78	152.96	152.48

SURVEYED JUNE 1991
COMBS LAND SURVEYING
19202 ALLINGHAM AVE
CERRITOS, CA. 90701
213- 865-7734



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